

|| LICHENS AND FERNS,  
GRASSES AND OTHER PHANEROGAMS

### ADVERTISEMENT.

The United States National Herbarium, which was founded by the Smithsonian Institution, was transferred in the year 1868 to the Department of Agriculture, and continued to be maintained by that department until July 1, 1896, when it was returned to the official custody of the Smithsonian Institution. The Department of Agriculture, however, continued to publish the series of botanical reports entitled "Contributions from the United States National Herbarium," which it had begun in the year 1890, until, on July 1, 1902, the National Museum, in pursuance of an act of Congress, assumed responsibility for the publication. The first seven volumes of the series were published by the Department of Agriculture.

RICHARD RATHBUN,  
*Assistant Secretary, Smithsonian Institution,*  
*in charge of the United States National Museum.*



SMITHSONIAN INSTITUTION  
UNITED STATES NATIONAL MUSEUM

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# CONTRIBUTIONS

FROM THE

# UNITED STATES NATIONAL HERBARIUM

VOLUME 17

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SYSTEMATIC INVESTIGATIONS  
IN  
LICHENS AND FERNS,  
GRASSES AND OTHER PHANEROGAMS

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HASSE, MAXON, HITCHCOCK,  
HITCHCOCK AND CHASE,  
STANDLEY, COOK



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## NOTE.

The eight parts of volume 17 of the Contributions were issued on the following dates:

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- Part 7, pages 541 to 608, May 23, 1916.
- Part 8, pages 609 to 626, June 28, 1916.



## PREFACE.

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In the Lichen Flora of Southern California, the first of the papers of this volume, the author, Dr. Hermann Edward Hasse, has brought together in synoptical form the results of many years of study of the lichens of that region. During the course of his investigations Doctor Hasse has been fortunate in having the cooperation and assistance of several distinguished European lichenists, upon whom he has relied mainly for the determination and description of new species. The method of classification followed is adapted from that proposed by Dr. A. Zahlbruckner in the *Natürlichen Pflanzenfamilien* of Engler and Prantl.

With respect to the use of generic names the situation at present is essentially as noted in connection with Professor Fink's work on the Lichens of Minnesota (published in volume 14 of the Contributions, 1910), since the principles which must govern a fundamental revision of these names remain unsettled. For several reasons it has seemed advisable in the present work, also, as there, to limit citations to the names of authors, except for species which have been recently described or renamed. In these instances full citations are given, mostly verified from the original sources.

The second paper, by Mr. William R. Maxon, Associate Curator of the National Herbarium, is the fourth of his series on tropical American ferns, and presents brief revisions of several small groups which have been much misunderstood. Attention is called also to the confusion which exists similarly in many, if not in most, groups of tropical American Pteridophyta, and to the practicability of meeting this condition by the publication of numerous short synoptical reviews, dealing with the species by genera, subgenera, or even smaller groups. Such a practice, if seriously and generally undertaken, could not fail to yield beneficial results.

During recent years the United States National Herbarium has received large collections of grasses from various parts of North America. Some of the larger genera have been revised and their nomenclature adjusted upon a type basis. It is planned to continue these revisions until all the North American species have been elaborated in this manner. Since revisions ought to include, as a part of the usual taxonomic study, an examination of type specimens, several years must elapse before the task is completed. To meet the



more immediate requirements, it seems desirable to prepare a preliminary series of grass floras which, though lacking in completeness and not elaborated wholly upon a type basis, will nevertheless be of service to students of grasses who have not ready access to the scattered literature of the subject. The third paper of this volume, by A. S. Hitchcock, Systematic Agrostologist of the United States Department of Agriculture, brings together in this preliminary way our knowledge of the grasses of Mexico. Since the paper represents preliminary work, it has seemed best to confine the study to specimens in the United States National Herbarium and to omit references to synonymy except in those cases in which the identity could be certainly established, or in which there was involved some change from current usage. The National Herbarium contains the collections of Dr. Edward Palmer, Dr. C. G. Pringle, Mr. E. W. Nelson, Dr. J. N. Rose and his assistants, and many other American collectors. There is also an important series of duplicates of several of the earlier European collectors, such as Liebmann, Galeotti, Botteri, and Bourgeau. During the summer and autumn of 1910 Professor Hitchcock made extensive collections in nearly all the States north of the Isthmus of Tehuantepec. The amount of Mexican material at hand is so large that the number of species omitted because of confining the study to specimens in the National Herbarium is probably not great. The number of species included by Professor Hitchcock in this paper is 615, of which 23 are described as new.

The next paper, by Mr. Maxon, is the fifth of his series already mentioned on tropical American ferns and fern allies, and, like the preceding ones, deals mainly with smaller groups of species which are in need of revision. In addition, there are descriptions of new species in *Marattia* and *Lycopodium*, genera which have been treated synoptically elsewhere within recent years. The publication of several new species of *Polypodium* is preliminary to a review of the North American species of that genus.

The fifth paper of the volume is by Mr. Paul C. Standley, of the United States National Herbarium, relating primarily to plants of Panama. The collections obtained during the recent biological survey of the Canal Zone and adjacent parts of Panama furnish to the National Herbarium means of greatly extending the knowledge of the botany of that region. In working over portions of this material Mr. Standley finds it desirable in many instances to include in his study specimens from other parts of tropical America. Since these studies are likely to extend over several years it has seemed advisable to publish the results in serial form. The present paper, with its revisions of genera, descriptions of miscellaneous new species, and corrections in nomenclature, is typical of the proposed series.



The succeeding paper (part 6), by Mr. Hitchcock and Agnes Chase, Assistant Agrostologist, is supplemental to a revision of the genus *Panicum* published by the same authors in volume 15 of the Contributions under the title of "The North American Species of *Panicum*." As stated in the preface to that paper, it was impossible at that time to offer a satisfactory treatment of the tropical species. Since then much additional material, including collections made by the authors, has been accumulated. The present paper includes the results of the study of these collections and presents a fairly detailed account of the genus in tropical North America. There are included 116 species and 3 subspecies. Of these, 9 species are described as new; 5 are South American species which were unknown within the limits of the area covered; 1 is a species recently described; and 4 are species that were cited as synonyms or listed as dubious species but are now considered valid. In all 19 species are added, making the total for the genus *Panicum* in North America 216. Each species is accompanied by an outline map graphically representing the geographical distribution within the Tropics of North America.

The seventh paper of the volume, the sixth of Mr. Maxon's series on tropical American ferns, is devoted chiefly to a revision of three widely misunderstood groups of species of the genus *Polypodium*. There are included descriptions of several additional new species of *Polypodium* and notes upon several species of *Notholaena*.

The final paper is by Mr. O. F. Cook, of the Bureau of Plant Industry, United States Department of Agriculture. In the course of his tropical American work Mr. Cook has made field studies of the characters and habits of the well-known cacao tree and a related food tree, the patashte. Though both of these have usually been referred to the genus *Theobroma*, their differences have seemed to Mr. Cook so great as to require their separation, and he has elsewhere published the new genus *Tribroma* based upon the patashte. In the present paper he compares the two trees from an ecological as well as a taxonomic point of view and develops a practical suggestion for securing increased productiveness by a system of pruning. The characters of the two genera are summarized at the close in technical descriptions.

FREDERICK V. COVILLE,  
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# THE LICHEN FLORA OF SOUTHERN CALIFORNIA.

BY HERMANN EDWARD HASSE.

## INTRODUCTION.

A study of the lichen growth of Southern California, pursued mostly in the county of Los Angeles for more than a score of years, has brought to light a number of species previously undescribed, as also the presence of some known species new to North America.

For the determination of these the writer was indebted to Dr. Ernst Stizenberger during his life, and afterward to the late Dr. William Nylander, who named a large number. Subsequently Dr. A. Zahlbruckner has kindly continued this work and has published some of the species determined by himself with a few of Doctor Nylander's briefly described new species.<sup>1</sup> A few species named by Nylander appeared in a posthumous publication under the title "Lichenes Ceylonenses."<sup>2</sup> Doctor Stizenberger, it is believed, did not publish any of the Southern California Lichens named by himself.

At various times and in different pamphlets and journals the writer has issued lists and short descriptions of his collections, and the consolidation of these scattered reports is, in part, the object of this paper. In the preparation the author has made free use of and has been guided by the work of Dr. A. Zahlbruckner, "Ascolichenes," in Engler and Prantl, "Die Natürlichen Pflanzenfamilien,"<sup>3</sup> the most important and advanced work of recent times on the subject. The suggestions of Dr. V. Darbishire as to designations of the apothecial structures, incorporated by Prof. M. Fünfstück in his "Lichenes" forming the "Allgemeiner Theil" of the same work,<sup>4</sup> have been adopted. The author also desires to express his grateful acknowledgment for aid given by several correspondents. Mr. S. B. Parish, of San Bernardino, kindly submitted a large collection determined by Doctor Stizenberger. Mr. C. R. Orcutt, of San Diego, generously gave a number of interesting forms determined by Prof. Edward Tuckerman, and Dr. A. C. Herre has contributed specimens of many species

<sup>1</sup> Bull. Torrey Club 27: 642-647. 1900; Beih. Bot. Centralbl. 13: 149. 1902.

<sup>2</sup> Act. Soc. Sci. Fenn. 26: 1-33. 1898.

<sup>3</sup> 1<sup>1</sup>\*: 49-243. 1907.

<sup>4</sup> Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1</sup>\*: 41.



demonstrating their range northward. Mrs. Blanche Trask, of Santa Catalina Island, sent valuable insular lichens. Miss Alice Eastwood, as Curator of the Herbarium of the California Academy of Sciences at San Francisco, lent a large heretofore undetermined collection of Pacific coast lichens, made by Dr. E. L. Greene, T. S. Brandege, Dr. Albert Kellogg, and others, representing plants from the extreme of Lower California to Alaska. This important collection was lost shortly after its return to San Francisco in the catastrophe of April 18, 1906. Mr. F. M. Reed, of Redlands, has also contributed valuable forms. To Dr. J. N. Rose, Associate Curator of the United States National Herbarium, the writer is especially desirous of expressing his great appreciation of the valued advice and help afforded in the preparation of this paper.

Briefly stated, Southern California, as here understood, is the portion south of the  $36^{\circ}$  parallel, containing the counties of Kern, Santa Barbara, Ventura, Los Angeles, Orange, Riverside, Imperial, and San Diego, in area amounting approximately to one-third that of the State. It may be divided into three main topographical sections, a coastal, a mountain, and a desert. The first ascends gradually from the coast line to the foothills of the second or mountain district, reaching an average altitude of 100 meters; it is mostly open country, sparsely wooded, fairly well watered, and mainly devoted to agriculture or grazing. Earth, rock, and corticular lichens are about equally represented in it. The second (mountain) section, facing southwestward, rises abruptly from the former to an average height of 1,500 meters, with several elevations up to 3,000 and 3,700 meters, and having a width of 150 kilometers, more or less; its flanks are clothed by an often impenetrable chaparral growth, while toward the summits a more open arboreal growth prevails. This district offers a rich vegetation of fruticulose and crustaceous as well as foliose lichens on earth, rock, and bark. From this toward the third or desert section the descent is more gradual and passes into the desert plateau of 1,200 meters elevation, gently sloping east and northeasterly, southward descending to, and in some localities even below, the sea level. This desert section is arid, practically waterless the greater part of the year, sustaining a brushy, with here and there a stunted arboreal vegetation. The lichens are chiefly terrestrial or saxicolous, bark forms being quite rarely seen. That the scanty precipitation and low atmospheric humidity are not entirely accountable for this paucity of lichen growth is evidenced by the fact that, though in localities sheltered from wind and sunlight, lichens flourish in a measure, they do not appear in as great variety of species as elsewhere. The prevailing, often severe, dust and sand storms form an active factor in prohibiting the life of lichens or their symbionts. In the coastal section the average annual precipitation is 30 to 45 cm., less



in the southern part, and considerably in excess of this in the mountain section, where at the highest points snow frequently lingers into June and July. In the second district the rainfall is very much less. Accurate meteorological statistics, however, for this and the mountain region are not available.

In the following systematic treatment species cited from definite localities without mention of the collector's name are either of common occurrence locally or have been collected by the writer. In the case of certain common cosmopolitan species it has seemed unnecessary to mention any specific localities.

### SYSTEMATIC TREATMENT.

#### LICHENES, subclass ASCOLICHENES.

##### KEY TO ORDERS.

- Hymenium soft, globose or semiglobose, covered  
or inclosed by the perithecium, perforated by  
an apical pore or fissure ..... **PYRENOCARPEAE** (p. 3).  
Hymenium exposed, disk-shaped ..... **GYMNOCARPEAE** (p. 14).

##### Order PYRENOCARPEAE.

Thallus mainly crustaceous or squamose (the few foliose or fruticose forms not found within our limits); algæ either bright green Chlorophycaceae (Pleurococcus, Palmella, Chroolepus algæ), or blue green Cyanophycaceae (Nostoc or Sirospion algæ); perithecium generally dark to black, brittle, globular (entire) or semiglobular (dimidiate), and wholly or partly immersed in the thallus; apical pore minute, punctiform or variously fissured; inclosed hymenial structures soft, gelatinous, with or without hymenial gonidia; paraphyses simple or branching, frequently gelatinous and indistinct and apparently absent; spermatia endobasidial or exobasidial.

##### KEY TO FAMILIES.

- Cavity of perithecium not divided by septa.  
Thallus with Pleurococcus or Palmella  
gonidia.  
Crustaceous ..... **VERRUCARIACEAE** (p. 3).  
Squamulose ..... **DERMATOCARPACEAE** (p. 8).  
Thallus with Chroolepus gonidia, crustaceous; perithecium without septa ..... **PYRENULACEAE** (p. 11).  
Thallus with Nostoc gonidia ..... **PYRENIDIACEAE** (p. 12).  
Cavity of perithecium completely or incompletely partitioned by septa ..... **MYCOPORACEAE** (p. 13).

##### VERRUCARIACEAE.

Thallus crustaceous, ecorticate; symbionts Pleurococcus or Palmella gonidia; perithecium simple, erect, perforated vertically by the apical aperture; thecal contents soft; paraphyses and asci membranes often gelatinous, indistinct, the former at times apparently absent. Our species do not contain hymenial gonidia.



## KEY TO GENERA.

Paraphyses soon gelatinous, indistinct or absent.

Spores simple..... VERRUCARIA (p. 4).

Spores not simple.

Spores 2 to 4-locular..... THELIDIUM (p. 6).

Spores muriform-multilocular..... POLYBLASTIA (p. 6).

Paraphyses permanent, distinct.

Spores simple..... THROMBIUM (p. 6).

Spores muriform-multilocular..... MICROGLAENA (p. 7).

## VERRUCARIA Scop.

Thallus crustaceous, presenting the different phases from pulverulent to smooth, and either areolate or disappearing.

## KEY TO SPECIES.

Apothecia wholly immersed in thallus, only the ostiole free.

Perithecia large.

Thallus brownish to dull black..... 7. *V. nigrescens*.

Thallus green brown, the color distinct when moist..... 8. *V. viridula*.

Perithecia small.

Thallus green black, thin..... 9. *V. dacryodes*.

Thallus black, finely rimose, thin..... 10. *V. maura*.

Apothecia not wholly immersed, sessile or only half immersed.

Perithecia sunken in matrix..... 1. *V. calciseda*.

Perithecia not sunken in matrix.

Thallus obsolete..... 5. *V. margacea terrestris*.

Thallus present.

Thallus white or whitish.

Whitish to light brown..... 2. *V. rupestris*.

Creamy white, mealy..... 3. *V. integrella*.

Thallus dull brownish.

Perithecium concolorous..... 4. *V. margacea papillosa*.

Perithecium black..... 6. *V. aethiobola*.

1. *Verrucaria calciseda* Lam. & DC.

Thallus pulverulent, whitish, giving its substratum a dull white coating, effuse, at times wanting; perithecia brownish black, depressed hemispherical, impressed in shallow cavities in the rock; ostiole irregularly poriform; perithecium dimidiate, dark brownish black, the amphithecium also dark; paraphyses gelatinous, apparently shorter than the asci, these ventricose, about 100  $\mu$  long, 28  $\mu$  thick; spores 8, colorless, simple, ovoid-ellipsoid, while inclosed in the ascus 11 to 13  $\mu$  long, 8 to 11  $\mu$  thick, when expelled measuring 20 to 24  $\mu$  by 8 to 11  $\mu$ ; hymenial gelatine staining light blue then vinous red with iodine.

On calcareous rocks at lower and middle elevations in the mountains of Ventura and Los Angeles counties. Of wide distribution in North America, also in Europe.

2. *Verrucaria rupestris* Schrad.

Thallus light grayish to dusky leathery brown, granular-furfuraceous; perithecia medium small, 0.2 to 0.25 mm. in diameter, numerous, semi-immersed in the thallus, the projecting perithecium dull black; spores oblong-ellipsoid, 20 to 27  $\mu$  long, 7 to 12  $\mu$  thick; paraphyses gelatinous, obscure; hymenial gelatine a pale claret color with iodine, the spores yellowish.



On granite rocks, common throughout our district. A North American lichen occurring also in northern Africa and Europe.

**3. *Verrucaria integrella* Nyl.**

Thallus pale grayish cream color, furfuraceous, indistinctly rimose-areolate; perithecia black, innate, sessile and projecting above the thallus, depressed-globular, dimidiate, the apical aperture very minute, often invisible; asci lanceolate, tapering upward; paraphyses absent; spores 8, ovoid, 17 to 20  $\mu$  long, 11 to 15  $\mu$  thick, the contents with one or several oil globules more distinctly defined than the episore; no reaction with iodine.

On argillaceous shale in the Santa Monica Range.

**4. *Verrucaria margacea papillosa* (Ach.) Nyl.**

Thallus sordid light green brown, effuse, subrimulose and rugulose; perithecia dull black, dimidiate, semiglobular, the lower part covered by the thallus; amphithecium soft, light brown; paraphyses gelatinous; asci ventricose, 80 to 92  $\mu$  long, 28 to 30  $\mu$  thick, the membrane gelatinous and indistinct; spores ovoid-ellipsoid, 16 to 20  $\mu$  long, 7 to 10  $\mu$  thick; hymenial gelatine stained yellow with iodine.

On argillaceous rock at Ballona Bluffs near Santa Monica.

**5. *Verrucaria margacea terrestris* Nyl. subsp. nov. in litt.**

Thallus indistinct or absent; perithecia semiglobular, black; spores as in the preceding variety.

On clay, foothills of the Santa Monica Mountains, near the Soldiers' Home.

**6. *Verrucaria aethiobola* (Wahl.) Ach.**

Thallus pale tan color or pale olive greenish, thin, subdeterminate or in small blotches, partly covering the base of the perithecium, this black, small, semiglobular, somewhat shining and with a minute aperture, dimidiate; asci broadly saccate and ventricose, gelatinous and indistinct like the paraphyses; hymenial gelatine pale vinous red with iodine; spores 8, oblong-ellipsoid, their granular contents clearing after KHO, 15 to 20  $\mu$  long, 6 to 8  $\mu$  thick.

Not rare in the Santa Monica Range on slaty rocks. Reported from Europe and eastern Asia.

**7. *Verrucaria nigrescens* Pers.**

Thallus brown black to dull black, loosely rimose-areolate and crumbling, often leaving the large perithecia exposed, these dimidiate, black, semiglobular, mostly covered by thallus except the apices; spores oblong-ellipsoid, 17 to 28  $\mu$  long, 8 to 12  $\mu$  thick.

Common on various rocks throughout North America, northern Africa, and Europe.

**8. *Verrucaria viridula* Ach.**

Thallus greenish brown, thick, moistened, dark olive green, areolate-diffract; perithecia large, black, dimidiate, conical, immersed in thallus, the tip alone being visible; spores 8, large, ovoid-ellipsoid, granular, 28 to 32  $\mu$  long, 12 to 15  $\mu$  thick.

Frequent on calcareous and other rocks in our district. Occurs in the middle western United States, in Europe, Oriental Asia, and North Africa.

**9. *Verrucaria dacryodes* Nyl.; Hasse, Bull. South. Calif. Acad. 2: 73. 1903.**

Thallus effuse, thin, dull greenish black to dark olive green, minutely rimose; perithecia small, semiglobular, dimidiate, covered by the thallus, the amphithecium dark gray; asci lanceolate, 60 to 68  $\mu$  long, 24 to 28  $\mu$  thick, very gelatinous; spores 8, obovate-oblong, one end attenuate, 14 to 17  $\mu$  long, 11  $\mu$  thick; paraphyses indiscernible; hymenial gelatine with iodine pale vinous red, the asci being better defined after staining, the membrane 4 to 6  $\mu$  thick, remaining hyaline and the contents of the asci staining yellowish orange.



On argillaceous schist, foothills of the Santa Monica Mountains near the Soldiers' Home.

Type deposited with Dr. W. Nylander in 1897; duplicates in the U. S. National Herbarium and in herb. Hasse ("E stirpe *V. polysticta*" Nyl. in litt.).

**10. *Verrucaria maura* Wahlenb.**

Thallus black, minutely rimose and papillate; perithecium of medium size, dimidiate, internally dark; paraphyses none; spores 8, oblong, 12 to 15  $\mu$  long, 7 to 8  $\mu$  thick; hymenial gelatine vinous red with iodine.

On calcareous beach rocks near Newport and San Pedro, also on Santa Catalina Island. Reported from South America, Europe, northern Asia, and Africa.

**THELIDIUM** Mass.

Thallus crustaceous, thin, uniform, diffuse; hypothallus obsolete; spores 2 to 4-locular.

**1. *Thelidium microbolum* (Tuck.).**

*Verrucaria microbolum* Tuck. Gen. Lich. 2: 269. 1872.

Thallus thin, whitish to pale ash color, minutely areolate; perithecia sessile, small, black, depressed-globular with a minute aperture; spores colorless, broadly ellipsoid, 4-locular, 28  $\mu$  long, 16  $\mu$  thick; paraphyses absent.

On calcareous incrustations, Mill Creek Canyon, at Skinners, San Bernardino Mountains at 1,300 meters elevation.

**POLYBLASTIA** Mass.

Spores muriform-multilocular; otherwise as in *Thelidium*.

**1. *Polyblastia intercedens* (Nyl.) Lönnr.**

Crustaceous, light greenish gray, thin, delicately rimose; perithecia medium large, dull black, dimidiate; aperture depressed; paraphyses absent; spores 8, broadly ellipsoid, 28 to 40  $\mu$  long, 16 to 18  $\mu$  thick; hymenial gelatine with iodine wine red.

Frequent in the Santa Monica Mountains on slaty schist.

**1a. *Polyblastia intercedens aethioboloides* (Nyl.).**

*Verrucaria intercedens aethioboloides* Nyl. Not. Sällsk. Faun. Fl. Fenn. Förh. 5: 276. 1861.

Thallus sordid pale grayish brown, thin, subdeterminate; perithecia minute, dull black; spores ellipsoid, muriform, 18 to 20  $\mu$  long, 8 to 10  $\mu$  thick.

Of the same habitat as the species but less frequent; differing from the latter in its smaller spores. Externally it is similar to *V. aethiobola*, but different in its muriform spores.

**THROMBIUM** Wallr.

Thallus crustaceous, uniform, scurfy-membranous, mucogelatinous when moist; perithecium globose, black, entire, small, immersed, only the minute black apex visible; paraphyses slender, persistent, without hymenial gonidia; asci clavate or cylindric; spores 4 to 8, colorless (with us).

**1. *Thrombium epigaeum* (Pers.) Schaer.**

Thallus thin, effuse, uniform, scurfy; perithecia barely visible by the punctiform black apex, entire; spores 8, colorless, obovate or oblong-ellipsoid, 19 to 23  $\mu$  long, 7 to 9  $\mu$  thick; hymenial gelatine with iodine yellow.

On earth. Foothills of the Santa Monica Range near the Soldiers' Home. Reported as common in North America and Europe.



**MICROGLAENA** Lönnr.

Thallus crustaceous, uniform; perithecia immersed in the thalline verrucæ, globose, entire, soft, light in color, dark only at the apex; paraphyses slender, branching, asci oblong-cylindric, 2 to 8-spored; spores ellipsoid, muriform-multilocular, colorless to brownish.

## KEY TO SPECIES.

- Thallus sordid whitish, squamulose..... 3. *M. subcorallina*.  
 Thallus dull greenish, minutely verruculose.  
     Spores brown..... 1. *M. hassei*.  
     Spores not brown..... 2. *M. sychnogonoides*.

**1. Microglaena hassei** Zahlbr. Beih. Bot. Centralbl. 13: 152. 1902.

Thallus epiphloeodal, thin, dull grayish green to slightly olive green, minutely verrucose, effuse, with *Palmella* gonidia; perithecia simple, solitary, sessile, minute; 0.2 to 0.3 mm. in diameter, the greater part covered by thallus, only the black, punctiform apex being free, dimidiate, olive brown, the ostiole punctiform; paraphyses slender, branching filiform, intertwining, esepstate, persistent; asci numerous, clavate, straight or slightly curved, the membrane thickened at the rounded apex, 90 to 110  $\mu$  long, 20 to 30  $\mu$  thick; spores 8, from colorless soon brownish, ellipsoid to ovoid-ellipsoid, muriform, 20 to 30  $\mu$  long, 9 to 13  $\mu$  thick.

On various barks, principally on *Juglans californica*. Type locality in Sepulveda Canyon of the Santa Monica Mountains, near the Soldiers' Home.

Type deposited with Dr. A. Zahlbruckner in Vienna, Austria; duplicates in herbarium of the New York Botanical Garden, U. S. National Herbarium, and herb. Hasse.

**2. Microglaena sychnogonoides** Zahlbr. Beih. Bot. Centralbl. 13: 151. 1902.

Thallus epiphloeodal, thin, effuse, subverruculose, grayish greenish, KHO —,  $\text{Ca}(\text{Cl O})_2$ —, with *Palmella* gonidia; perithecia minute, 0.3 to 0.5 mm. in diameter, dispersed, depressed, semiglobose, the lower part surrounded by thallus, brownish gray or brown, minutely umbilicate, simple, yellowish red with iodine; paraphyses slender, filiform, about 1  $\mu$  thick, loosely branching and interwoven; asci subcylindric, straight, 90 to 110  $\mu$  long, 17 to 20  $\mu$  thick, the membrane thickened, 4-spored; spores colorless, muriform, 20 to 34  $\mu$  long, 9 to 11  $\mu$  thick.

On the smooth bark of limbs of *Quercus agrifolia*. Type locality, Santa Monica Range near the Soldiers' Home.

Type deposited with Dr. A. Zahlbruckner; duplicates with Dr. A. C. Herre and in herb. Hasse.

**3. Microglaena subcorallina** sp. nov.

*Verrucaria subcorallina* Nyl. in litt., name only.

Thallus epiphloeodal, moderately thick, minutely squamulose or warty, sordid whitish, or sordid grayish dun in color; apothecia imbedded in thalline warts, solitary or rarely two upon a squamule, prominent, semiglobular or subconical, slightly darker than the thallus and, when moist, darkening toward the apex around the impressed vertical aperture; perithecium soft, globose, entire, pale reddish on section; paraphyses capillary, densely intertwining, longer than the asci, apparently branching; asci numerous, mostly lightly curved, cylindric, a little thicker above the base, the membrane thick (about 4  $\mu$ ); spores 8, colorless, ellipsoid in outline, muriform-multilocular, with 5 to 8 septa in the transverse (short) axis, each locus with 1 to 3 septa in the long spore axis; spores generally disposed longitudinally in single file, 36 to 44  $\mu$  long, 14 to 20  $\mu$  thick; with iodine, spores and ascus contents staining a rich yellow, the ascus membrane and paraphyses not staining.

On smooth bark of young oaks on the western slope of the San Gabriel Range at about 800 meters altitude, along the "New Trail" to Mount Wilson (the type locality).

Type deposited with Dr. W. Nylander in 1897; duplicate in herb. Hasse.



## DERMATOCARPACEAE.

Thallus foliaceous or squamulose, both surfaces or only the upper with a pseudo-membranaceous cortex, attached centrally by a basal disk or basal rhizinæ, or by the medullary hyphæ to the substratum; with *Palmella* gonidia; perithecium simple, with a punctiform, vertical aperture (ostiolum); spermatia endobasidial.

## KEY TO GENERA.

- Thecium without hymenial gonidia, spores simple..... *DERMATOCARPON* (p. 8).  
Thecium with hymenial gonidia, spores muriform ..... *ENDOCARPON* (p. 9).

*DERMATOCARPON* Eschw.

Thallus foliaceous or squamulose; perithecium tubular or ovoid, dark or pallid, sunken in the thallus or slightly protruding; paraphyses gelatinous and ill defined; spores colorless, simple; sterigma minute, spermatia oblong, straight.

## KEY TO SPECIES.

Thallus foliaceous.

Monophyllous, large ..... 4. *D. miniatum*.

Polyphyllous, the folia small..... 4a. *D. miniatum complicatum*.

Thallus not foliaceous.

Thallus squamose.

Squamæ lobed to deeply incised, brown..... 1. *D. rufescens*.

Squamæ round to flexuose, brown..... 2. *D. hepaticum*.

Thallus more or less bullate.

Bullate in the center, the peripheral squamæ  
expanding..... 5. *D. intestiniforme*.

Subverruculose-bullate, dark brown..... 3. *D. acarosporoides*.

1. *Dermatocarpon rufescens* (Ach.) Zahlbr. in Engl. & Prantl. Nat. Pflanzenfam. 1<sup>1\*</sup>: 60. 1907.

*Endocarpon rufescens* Ach. Lich. Univ. 304. 1810.

Thallus of reddish brown squamæ, lobed, often deeply incised, the margin generally everted and dark granulose; above a thin, brown, pseudoparenchymatous cortex, beneath this thick, closely jointed, vertical hyphæ descending into and through the gonidial layer, merging into the cellular medullary layer; lower surface ecorticate; apothecia, when present, one or more in a squamule, generally from 3 to 6 (indicated by a darkened spot), with minute apertures; asci lanceolate and clavate; spores ellipsoid, 13 to 16  $\mu$  long, 5 to 8  $\mu$  thick, often containing 1 to 3 oil globules; paraphyses not present; hymenial gelatine stained bronze copper color with iodine, KHO giving no reaction; plant often dioecious, many squamules being without apothecia, but spermogones frequent, seen on section as small, light flesh-colored globules under the cortex; spermatia minute, oblong, 4  $\mu$  long and about 1  $\mu$  thick.

Common on earth in open places throughout our district. Near San Bernardino, *Parish*; Santa Cruz Peninsula, *Herre*, and frequent in the Santa Monica Range. New England States; Europe; northern Africa.

2. *Dermatocarpon hepaticum* (Ach.) T. Fries.

Squamules flat, not turned up at the edges, round or roundish to flexuose; asci oblong, 72 to 92  $\mu$  long, 15 to 18  $\mu$  thick, upper part of membrane thickened, covering the cavity calyptra-like; ascus membrane not stained by iodine, but its contents and spores staining a reddish orange to dark copper color and the hymenial gelatine vinous red; spores 8, oval-ellipsoid, 11 to 14  $\mu$  long, 7 to 10  $\mu$  thick.

Same habitat as the preceding and about as frequent. North America and Europe.



**3. *Dermatocarpon acarosporoides* Zahlbr. Beih. Bot. Centralbl. 13: 153. 1902.**

Thallus of bullate, subverruculose squamules, fissured or lobulate, thick, reddish brown, discrete or forming a continuous crust, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia single or rarely two in a squamule, immersed, the apex blackening, punctiform, depressed-umbilicate; peritheciium globose, pale; paraphyses indistinct; hymenium with iodine vinous red; asci ventricose, cuneate at the base,  $80\ \mu$  long by  $20\ \mu$  thick; spores in 8's, simple, hyaline, globose or subglobose, 10 to  $12\ \mu$  in diameter.

On granite. Type locality, Palm Springs, at the base of the San Jacinto Mountains, at 150 meters altitude.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**4. *Dermatocarpon miniatum* (L.) Mann.**

Thallus foliaceous, monophyllous or submonophyllous, beneath centrally attached; fronds 2 to 3.5 cm. wide, roundish, lobed, the margin entire or crenate, pale mouse-colored above, smoothish, leathery brown to dark brown beneath, brittle when dry; apothecia immersed, minutely umbilicate; asci oblong,  $80\ \mu$  long,  $12\ \mu$  thick, the membrane thickened, especially at the top, leaving the cavity attenuate above; membrane not stained by iodine, but its contents yellow; spores in 8's, oblong-ellipsoid, 14 to  $20\ \mu$  long, 4 to  $7\ \mu$  thick; hymenial gelatine blue with iodine.

On rocks; not very common but widely distributed in our district. Yosemite Valley; Tehachapi Mountains; San Gabriel Mountains; Palm Springs. North America, northern Africa, and Europe.

**4a. *Dermatocarpon miniatum complicatum* (Swartz) T. Fries.**

Thallus foliaceous but the fronds smaller, polyphyllous and imbricated, ascending, somewhat cespitose; asci subcylindric, the upper part of the membrane thickened as in the last species, very gelatinous; hymenial gelatine with iodine violet blue, the asci cavities yellow, the membrane not stained; spores in 8's, ellipsoid-ovoid, 12 to  $16\ \mu$  long, 6 to  $8\ \mu$  thick; spermatia short, straight, apparently slightly thickened at the ends, 5 to  $6\ \mu$  long, about  $1\ \mu$  thick.

On rocks; of the same distribution as the species. San Bernardino Mountains, Parish.

**5. *Dermatocarpon intestiniforme* (Koerb.).**

*Endocarpon intestiniforme* Koerb. Par. Lich. 42. 1860.

Thallus polyphyllous, caespitose, creamy gray in color or sometimes with a faint bluish dash, the borders of the squamæ directed downward, forming bullose cavities of the coarsely areolate central part, the areoles roundish, subangular or frequently angular-wavy, each squamule or bulla containing mostly several apothecia; peripheral squamæ foliaceous, expanding and imbricate; apothecia at first immersed, later becoming prominent, the extruding peritheciium dull black with a minute ostiole, the immersed part soft, globular to flattened-globular, of a pale flesh color; thecium colorless; paraphyses gelatinous, indistinct; asci cylindric or bottle-shaped; spores 8, bluntly ellipsoid, colorless, faintly granular, 12 to  $18\ \mu$  long, 6 to  $9\ \mu$  thick; hymenial gelatine staining blue with iodine, soon changing to orange brown; KHO giving no reaction.

On rocks and earth in crevices of rocks. North Fork of Matilija Canyon, Ventura County; Eden Hot Springs and Palm Springs, Riverside County, to the Grand Canyon in Arizona.

**ENDOCARPON Hedw.**

Thallus foliaceous-squamose, both surfaces or only the upper with a pseudoparenchymatous cortex; peritheciium immersed or protruding with the apex simple, erect; thecium with oblong or rounded hymenial gonidia; proper exciple dark; paraphyses gelatinous; asci saccate or ventricose, 1 to 6-spored; spores oblong or ellipsoid, muriform-multilocular, at first colorless, soon light yellowish brown to brown; spermatia cylindric, straight.



## KEY TO SPECIES.

Growing on earth; squamulose.

Whitish to light gray.....3. *E. lepidallum*.

Some shade of brown.

Pale brown; squamules roundish to oblong.....1. *E. pusillum*.

Reddish brown; squamules roundish.....2. *E. subnitescens*.

Growing on rock; thallus minutely squamulose.

Black, small, round, discrete or in confluent patches.....4. *E. wilmsoides*.

Olivaceous-cinerascent, effuse.....5. *E. monicae*.

**1. *Endocarpon pusillum* Hedw.**

Thallus of pale brown or dusky buckskin-colored squamules, roundish to irregularly oblong, entire or flexuous, closely adhering to the substrate, 1 mm. in diameter, or 2.8 mm. long by 1.5 mm. to 2 mm. wide; apothecia marked by a darker colored slight projection, mostly several in a squamule, the aperture minute; on section the perithecium and contents seen dark, globular; asci cylindric-clavate, the membrane thick, gelatinous, indistinct; paraphyses none; spores in 2's, from colorless to light brown and brown, muriform-multilocular, 11 or 12 loculi in the long spore axis and 3 or 4 in the short transverse axis; spores varying in form from ellipsoid to oblong, 32 to 44  $\mu$  long, 13 to 20  $\mu$  thick.

On earth in open places near the Soldiers' Home, Santa Monica Mountains; also near San Bernardino, *Parish*. Eastern and southern United States and Europe.

**2. *Endocarpon subnitescens* Nyl.**

Thallus squamulose, the squamules 1 to 3 mm. wide, reddish brown, thin, lobulate, adherent to the substrate; one to several apothecia immersed in a squamule, their location marked by a brown convexity, the ostiole not discernible; asci 140  $\mu$  long, 60  $\mu$  thick, the membrane gelatinous; spores in 2's, colorless to pale yellowish, muriform, 46 to 80  $\mu$  long, 18 to 28  $\mu$  thick; hymenial gelatine with iodine pale claret.

On earth in the Santa Monica Mountains.

**3. *Endocarpon lepidallum* Nyl. sp. nov. in litt.**

Thallus of small squamules (0.25 mm. to 2 mm. wide), from whitish to pale smoky gray, at first round, later flexuous and lobed, the margin finely granular and blackish, when dry the squamules slightly concave with the margin turned upward; squamules containing from 1 to about 12 apothecia, these immersed, only a minute gray protuberance with a barely discernible ostiole marking them; perithecium dark, dimidiate, black under the hand lens, brown black under a higher power, 52 to 56  $\mu$  thick, the thecial cavity 140 to 160  $\mu$  in diameter; asci 60  $\mu$  long, 20  $\mu$  thick, the apical perforation vertical, widening upward, funnel-shaped, the membrane quite thick but gelatinous and almost invisible; paraphyses none; spores in 2's, ovoid to oblong and ovoid-ellipsoid, at first colorless, later pale brown, 28 to 40  $\mu$  long, 14 to 18  $\mu$  thick, muriform with 8 loculi in the longitudinal spore axis, and 3 or 4 in the transverse, the cells cubic; hymenial gelatine vinous red with iodine, the ascus membrane faintly so and its contents rich yellow to orange, sterigma indistinctly articulate, somewhat curved, spermatia minute, barely 1  $\mu$  long. The lower surface of the thallus is ecorticate; the upper has a cortex of horizontally flattened cells immediately beneath, these forming the gonidial layer.

On earth in open places. Type locality, foothills of the Santa Monica Mountains near the Soldiers' Home.

Type deposited with the late Dr. W. Nylander; duplicates in the U. S. National Herbarium, the herbarium of the New York Botanical Garden, and herb. Hasse.

**4. *Endocarpon wilmsoides* Zahlbr. Beih. Bot. Centralbl. 13: 152. 1902.**

Thallus of discrete or confluent small, round patches, 3 to 8 mm. in diameter, minutely rimulose, sooty olivaceous in color; apothecia solitary or 2 in the minute



thalline verrucæ, immersed, the apex dull black, the ostiole hardly visible, the perithecium obscurely brown, dimidiate; thecium pallid, globose; paraphyses distinct, filiform, subclavate above; asci 80 to 100  $\mu$  long, 29 to 32  $\mu$  thick, the membrane thickened at apex; spores in 2's, at first colorless, later brownish, ovoid and oblong-ovoid, muriform, the loculi subglobose, 8 to 10 in the long spore axis and 3 to 5 in the transverse; spores 35 to 44  $\mu$  long, 14 to 21  $\mu$  thick, staining yellow with iodine, the hymenial gelatine a coppery brown.

Type locality in the Santa Monica Mountains near Encino, on argillaceous schist.

Type deposited with Dr. A. Zahlbruckner; duplicates distributed to the late Prof. Clara Cummings, Rev. C. H. Demetrio, Dr. A. C. Herre, and Dr. B. de Lesdain, and in herb. Hasse.

**5. *Endocarpon monicae* Zahlbr. Beih. Bot. Centralbl. 13: 153. 1902.**

Thallus effuse, thin, of minute, olivaceous-cinerascent, subverruculose squamules, loosely aggregated, the fertile ones being slightly larger, containing one or two apothecia, these subimmersed, dull black, the ostiole barely visible; perithecium dark, dimidiate; thecium pallid, globose, 240 to 270  $\mu$  in diameter; hymenial gonidia numerous; paraphyses gelatinous; asci saccate-clavate or clavate, 120 to 140  $\mu$  long, 24 to 28  $\mu$  thick, the membrane above slightly thickened; spores in 2's or 3's, oval, oval-oblong, or oblong, muriform, pale brownish, 26 to 55  $\mu$  long, 10 to 20  $\mu$  thick, 8 to 14 cells in the long spore axis, 4 or 5 in the transverse; hymenial gelatine with iodine a sordid greenish.

Type locality in the Santa Monica Mountains near Encino on argillaceous schist.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

## PYRENULACEAE.

Thallus crustaceous, uniform, ecorticate, devoid of rhizinæ; algal symbiont a *Chroolepus*; perithecia solitary (in our species), erect with a vertical aperture; spermatia exobasidial.

### KEY TO GENERA.

Paraphyses loosely branching and internetting or absent.... *ARTHOPYRENIA* (p. 11).

Paraphyses not branching, separate.

Asci 4 to 8-spored, the spores 2 to several-locular..... *PORINA* (p. 12).

Asci many-spored, the spores 2 and 4-locular..... *THELOPSIS* (p. 12).

## ARTHOPYRENIA Mass.

Paraphyses loosely branching and internetting or absent; spores 2 to 6-locular, colorless, ovoid or oblong.

### KEY TO SPECIES.

Apothecia minute..... 1. *A. parvula*.

Apothecia medium-large..... 2. *A. biformis*.

**1. *Arthopyrenia parvula* Zahlbr. Beih. Bot. Centralbl. 13: 149. 1902.**

Thallus epiphyllæodal, thin, pale grayish, smooth, generally forming small patches; KHO—, Ca(ClO)<sub>2</sub>—; apothecia minute, separate, rarely grouped, globose, black, the base slightly covered by the thallus, monocarpous, the apex becoming later depressed and punctiform-perforated; perithecium entire, dark, internally pallid, staining yellow with iodine; paraphyses filiform, about 1.5  $\mu$  thick, 80 to 90  $\mu$  long, 9 to 11  $\mu$  thick; spores in 8's, disposed in one row, colorless, ovoid, bilocular, the loculi unequal, 14 to 16  $\mu$  long, 5 to 6  $\mu$  thick.

On *Umbellularia californica* in Malibu Canyon (the type locality) in the Santa Monica Mountains.



**2. *Arthopyrenia biformis* (Borr.) Muell. Arg.**

Thallus gray, smoothish or finely furfuraceous, diffuse; apothecia entire, conical-semiglobular, black, glistening, scattered, their base partly covered by minute thalline furfur; paraphyses slender, scantily branching, and loosely interwoven; asci cylindric,  $100\ \mu$  long,  $12\ \mu$  thick; hypothecium pallid; spores in 8's, bilocular, often parted unequally by the septa, slightly curved, ovoid to oblong-ovoid, 12 to  $17\ \mu$  long, 7 to  $8\ \mu$  thick; hymenial gelatine giving no reaction with iodine.

Santa Catalina Island on *Heteromeles arbutifolia*.

**PORINA Ach.**

Paraphyses not branching, separate; asci 4 to 8-spored, the spores 2 to several-locular. A single species found within our limits.

**1. *Porina plumbaria* (Stizenb.) Erythraea 3. 1895.**

*Verrucaria plumbaria* Stizenb. Bull. Torrey Club 24: 448. 1897.

*Verrucaria carpinea plumbaria* Nyl.; Hasse, Lich. South. Calif. 18. 1898.

Thallus thin, smooth, silver gray; apothecia numerous, dispersed; perithecium horny, black, shining, semiglobose with a minute aperture; paraphyses loosely netted-branching, distinct, permanent; hypothecium colorless; asci cylindric, straight,  $60\ \mu$  long,  $12\ \mu$  thick; spores fusiform, bilocular, the loculi equal, and in fully matured spores each locus constricted, mostly disposed in single file, or somewhat oblique, in some cases partly in two rows, 15 to  $20\ \mu$  long, 3.5 to  $4\ \mu$  thick; with iodine the hypothecium and protoplasm of the ascus contents staining yellow, except the ascus membrane, this with the spores and paraphyses not affected by the reagent.

Frequent in the Santa Monica Range on various smooth barks, principally on *Quercus agrifolia*.

**THELOPSIS Nyl.**

Asci many-spored, the spores 2 to 4-locular; otherwise as in *Porina*.

Represented with us by one species.

**1. *Thelopsis subporinella* Nyl. sp. nov. in litt.**

Thallus crustaceous, uniform, the hypothallus invisible; apothecia mostly crowded, embedded in soft, buff colored, thalline warts, solitary or sometimes 3 or 4 in a wart (without a stroma formation), a light brown ostiole situated at the apex of the globular thalline verruca; paraphyses not sharply defined but permanent, not branching, filiform; asci fusiform and broadly fusiform, membrane thin,  $180\ \mu$  long, 20 to  $30\ \mu$  thick, spores numerous in the spore sac, colorless, bilocular, oblong-ellipsoid, 13 to  $18\ \mu$  long, 6 to  $7\ \mu$  thick, the epispore thin, surrounded by a narrow halo; ascus contents and hypothecium staining pale amber with iodine, the ascus membrane and the spores and paraphyses not affected.

On *Umbellularia californica* in Malibu Canyon (type locality) of the Santa Monica Range.

**PYRENIDIACEAE.**

Thallus membranaceous, crustaceous-squamulose, or foliaceous, homœomerous or stratified, with Nostoc or Sirospion gonidia; perithecia simple, vertical.

**HASSEA Zahlbr.**

*Hassea* Zahlbr. Beih. Bot. Centralbl. 13: 150. 1902.

"Thallus crustaceus, uniformis, hyphis medullaribus substrato affixus, rhizinis destitutus, homoeomericus, ecorticatus, gonidiis nostocaeis, glomerulosis. Apothecia pyrenocarpica, simplicia, gonidiis hymenialibus nullis, perithecio recto, fuligineo. Paraphyses laxa ramoso-connexae, parum conspicuae. Asci 8-spори. Sporae bacillares, simplices et hyalinae. Pycnoconidia ignota."



1. *Hassea bacillosa* (Nyl.) Zahlbr. Beih. Bot. Centralbl. 13: 150. 1902.

*Verrucaria bacillosa* Nyl.; Hasse, Lich. South. Calif. 19. 1898.

Thallus crustaceous, effuse, leprose-furfuraceous, subareolate-rimose, obscurely olivaceous brown, quite thin, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ , ecorticate; (according to the author of this new genus,) gonidia of the Nostoc type, embedded in a gelatinous mass and subconcatenate (3 or 4 cells connected); apothecia sessile, dispersed, 0.2 to 0.3 mm. wide, conical-semiglobose, black, somewhat glistening; perithecium erect, dimidiate, fuliginous, the ostiole punctiform, inconspicuous, at last lightly impressed; nucleus pallid, not changed by iodine; paraphyses lax, sparsely branched and connected; asci scarce, oblong-cuneate, straight or moderately curved, 43 to 48  $\mu$  long, 8 to 10  $\mu$  wide, the membrane not thickened; spores in 8's, arranged vertically, hyaline, simple, bacilliose, straight or nearly so, their apices rounded and slightly broadened, 30 to 40  $\mu$  long, 1.8 to 2.1  $\mu$  thick; spermatia not known.

On crumbling sandstone. Type locality, foothills of the Santa Monica Range near the Soldiers' Home.

Type deposited with Dr. W. Nylander; duplicates with Dr. A. Zahlbruckner and in herb. Hasse.

### MYCOPORACEAE.

Thallus crustaceous, uniform, with *Palmella* or *Chroolepus* gonidia; hymenium composite, divided by partitions, with apical apertures.

Based upon the characters of the spores two genera have been formed: *Mycoporum*, with *Palmella* gonidia and muriform spores and *Mycoporellum*, with *Chroolepus* gonidia and bilocular spores. Two species of the latter genus concern us as sole representatives in southern California.

### MYCOPORELLUM Muell. Arg.

Gonidia *Chroolepus*; spores bilocular.

#### KEY TO SPECIES.

Thallus absent; apothecia parasitic on other lichens..... 1. *M. epistigmellum*.

Thallus present, whitish, diffuse..... 2. *M. hassei*.

1. *Mycoporellum epistigmellum* sp. nov.

*Mycoporum epistigmellum* Nyl. in litt.

Thallus absent; apothecia parasitic upon disks of *Blastenia festiva* and on the thallus of *Acarospora obpallens* and *A. chlorophana*; paraphyses absent; asci oblong-ellipsoid and oblique-ellipsoid, acuminate at the tops, the membrane there thickening, straight or slightly curved, 48 to 56  $\mu$  long, 14 to 15  $\mu$  thick; spores in 8's, bilocular, colorless, oblong-ellipsoid, 16 to 20  $\mu$  long, 3.5 to 4  $\mu$  thick, the lower loculus narrower and more acuminate than the other; asci stained yellow by iodine.

Type locality, foothills of Santa Monica Range near the Soldiers' Home.

Type deposited with Dr. W. Nylander; duplicate in herb. Hasse.

2. *Mycoporellum hassei* Zahlbr. sp. nov. in litt.

Thallus whitish colored, diffuse, thinly squamulose; apothecia scattered, 0.4 to 1 mm. wide, dull black, flattish, under the hand lens seen finely papillate; paraphyses absent; asci oblong-ellipsoid, 60 to 80  $\mu$  long, 20 to 28  $\mu$  thick, the membrane about 3  $\mu$  thick, the upper attenuate part solidly thickened; spores in 8's, colorless, bilocular, oblong, 20 to 28  $\mu$  long, 8 to 10  $\mu$  thick, the lower loculus slightly thinner and longer than the upper; hymenial gelatine staining pale yellow with iodine, the ascus contents pale vinous red; no change with KHO.



Dr. A. Zahlbruckner writes: "Von den übrigen Mycoporellum Arten mit zweizelligen, farblosen Sporen durch die grosse Zahl der Mündungen des Apotheciums (15-18) unterschieden, ausserdem von *M. lahmii* durch kleinere Sporen und von *M. ellipticum* durch die nicht zylindrischen Sporen abweichend; am nächsten kommt sie noch der *M. eschweileri*, doch diese hat nur wenig Osteola."

Type locality, Santa Catalina Island near Avalon, on *Crossosoma californicum*.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

### Order GYMNOCARPEAE.

Disk round or narrowed and lengthened (lirellaeform), more or less exposed, not covered by the margin (exciple), covered, however, by the prolonged and densely interwoven paraphyses forming a "capillitium," these becoming intermingled with the soon liberated spores, forming the so-called "mazædium."

#### KEY TO SUBORDERS.

Paraphyses and spores forming a mazædium..... CONIOCARPINEAE (p. 14).

Paraphyses and spores not forming a mazædium.

Disk linear to elongate and ellipsoid ..... GRAPHIDINEAE (p. 16).

Disk circular..... CYCLOCARPINEAE (p. 29).

### Suborder CONIOCARPINEAE.

Thallus partaking of the cardinal forms, foliaceous, crustaceous or fruticulose; symbionts Pleurococcus, Protococcus, Stichococcus, or Chroolepus gonidia; disk exposed, roundish or elongate; asci cylindric, soon disintegrating and forming a mazædium with the liberated spores.

#### KEY TO FAMILIES.

Apothecia stipitate..... CALICIACEAE (p. 14).

Apothecia sessile..... CYPHELIACEAE (p. 15).

### CALICIACEAE.

Thallus thinly crustaceous, granulose or wanting; gonidia as above, excluding Chroolepus; apothecia stipitate or sessile, with more or less globose heads.

#### KEY TO GENERA.

Apothecia not stipitate, sessile or subsessile..... SPHINCTRINA (p. 15).

Apothecia stipitate.

Disk open..... CALICIUM (p. 14).

Disk inclosed, punctiform..... STENOCYBE (p. 15).

### CALICIUM Pers.

Thallus crustaceous, granular to warty; apothecia stipitate, the disk open.

#### KEY TO SPECIES.

Thallus granulose, greenish yellow, effuse..... 1. *C. hyperellum*.

Thallus macular or absent, if present grayish..... 2. *C. parietinum*.

#### 1. *Calicium hyperellum* Ach.

Thallus greenish yellow, granular or leprose; apothecia on black stipes, the heads globose-lenticular, beneath brownish; spores 8, blackish, ellipsoid, bilocular, one locus generally narrowed, 11 to 16  $\mu$  long, 5 to 8  $\mu$  thick, becoming dark brown with maturity; paraphyses free, some forked above; asci clavate or tubular, 40  $\mu$  long,



10  $\mu$  thick, upon a podetium almost equally long; hypothecium sienna brown; hymenial structures staining yellow with iodine.

On bark of conifers, Yosemite Valley; on *Pseudotsuga macrocarpa* in the San Gabriel Range.

## 2. *Calicium parietinum* Ach.

Thallus insignificant or absent; apothecia globose-lenticular, the under side and the stipe brownish black, the somewhat more flattened upper surface black, overreaching the margin a little; asci cylindric; spores in 8's, simple, grayish to light brown, ellipsoid, 7 to 10  $\mu$  long, 4 to 5  $\mu$  thick.

On dead, decorticated oak, Strawberry Valley in the San Jacinto Mountains, and on dead *Sambucus* in canyons of the Santa Monica Range.

## STENOCYBE Nyl.

Thallus absent; apothecia stipitate, the disk open.

### 1. *Stenocybe tremulicola* Norrl.

Apothecia globular, with a minute punctiform aperture, on a short, slender stipe; differing from *S. byssacea* Fries in the smaller spores, these in our species 12 to 18  $\mu$  long, 4 to 5  $\mu$  thick, nigrescent, oblong-ellipsoid, and bilocular to quadrilocular.

On smooth bark of limbs of *Juglans californica* in canyons of the Santa Monica Range.

According to Hue, Nylander makes this a subspecies of *Stenocybe byssacea* Fries.

## SPHINCTRINA Fries.

Thallus absent; apothecia sessile or subsessile.

### KEY TO SPECIES.

- |                                     |                             |
|-------------------------------------|-----------------------------|
| Apothecia sessile or nearly so..... | 1. <i>S. microcephala</i> . |
| Apothecia short-stipitate.....      | 2. <i>S. turbinata</i> .    |

### 1. *Sphinctrina microcephala* Nyl.

Apothecia black, globular; spores simple, ellipsoid, brown, 9 to 12  $\mu$  long, 6 to 8.5  $\mu$  thick; asci tubular; paraphyses filiform; hymenial gelatine staining indigo blue with iodine.

Parasitic on thallus of *Pertusaria lecanina* and *P. pustulata* on bark of *Quercus agrifolia* in the Santa Monica Range.

### 2. *Sphinctrina turbinata* Fries.

Thallus absent; apothecia short-stipitate; spores globular, brown, simple, 6 to 8  $\mu$  in diameter; asci tubular, 56  $\mu$  long, 6 to 8  $\mu$  thick; paraphyses separate, shorter than the asci; hymenial gelatine giving no reaction with iodine.

On thallus of *Cypheium bolanderi*, Ballona Bluffs near Santa Monica.

## CYHELIAE.

Thallus crustaceous, uniform; gonidia.

Protococcus, and *Chroolepus*

## CYPHELIUM

Thallus thin, granulose or verrucose, uniform or becoming effigurate at the periphery; apothecia sunken in the thalline verrucæ, eventually the disk expanding and open; paraphyses few, filiform; asci clavate; spores in 8's, arranged in one row, bilocular, rarely with more cells or simple.

### KEY TO SPECIES.

- |                              |                          |
|------------------------------|--------------------------|
| Spores simple.....           | 1. <i>C. bolanderi</i> . |
| Spores bilocular.            |                          |
| Thallus greenish yellow..... | 2. <i>C. tigillare</i> . |
| Thallus light gray.....      | 3. <i>C. inquinans</i> . |



1. *Cyphelium bolanderi* (Tuck.) Zahlbr. in Engl. & Prantl. Nat. Pflanzenfam. 1<sup>1\*</sup>: 84. 1907.

*Acolium bolanderi* Tuck. Syn. N. Amer. Lich. 136. 1888.

Thallus light grayish buff or grayish ochraceous, the warts more or less approximate, at times showing a tendency to lobation at their peripheries, a narrow, delimiting, black hypothalline border not always present; paraphyses filiform; asci torulose-cylindrical, containing 8 spores, these simple, at first colorless, at last brown to dark brown, from 9 to 20  $\mu$  in diameter, the greater number of medium size and showing a round central gray spot, the larger of a uniform dark brown; hymenial structures giving no reaction with iodine or with KHO.

Frequent on various rocks in southern California.

In reply to lichens sent him, the late Doctor Stizenberger wrote, in 1898, regarding this species: "*Acolium bolanderi* (olivenfarbige Thalluswarzen mit weissberandetem Sporenhäufchen)=ächtes *A. bolanderi*, aber Tuckerman hat hier einen groben Fehler begangen, wie früher Körber und Hepp ihn bei ähnlichen Gebilden auch machten (ebenso der alte Fée). Sie sahen einen parasitischen Hyphomyceten für Caliciaceen an. Wir haben hier einen Rostpilz auf dem Thallus von *Lecanora angelica* Stiz. vor uns." Again, later in the same year, he wrote: "*Acolium bolanderi* ist ein Uredo-ähnlicher Pilz und keine Flechte."

2. *Cyphelium tigillare* (Pers.) T. Fries.

Thallus greenish yellow, granulate or loosely areolate, effuse; apothecia innate to subsessile, the disk black, flat; asci cylindric; paraphyses few, separate; spores 8, bilocular, constricted, 11 to 24  $\mu$  long, 7 to 12  $\mu$  thick, smoky gray to brown with a round gray spot in each locus.

On dead pine wood, San Jacinto Mountains; dead shrubs near Murietta; dead wood, Tehachapi Mountains.

3. *Cyphelium inquinans* (J. E. Smith) Trevis.

Thallus whitish to light gray, granulose, often indistinct; apothecia small, sessile, a thalline margin indistinct, disk dull black, flat; spores bilocular, light brown to dark brown in the largest, constricted, 13 to 24  $\mu$  long, 7.5 to 11  $\mu$  thick; gonidia *Protococcus*, large.

On bark of conifers in the Tehachapi Mountains.

#### Suborder GRAPHIDINEAE.

Thallus crustaceous, passing from corticate, or with a defective cortex, to higher developed forms with a distinct cortex and finally to fruticose states with a pronounced medullary layer and cortex; the crustaceous forms affixed to the substrate by medullary or hypothalline hyphæ, the fruticose by means of a basal disk; gonidia consisting of *Palmella* or *Chroolepus* algæ (lichens of this class in symbiosis with *Phycopeltis* or *Phyllactidium* algæ having never yet been found with us); apothecia marginless (*Arthoniaceae*), or with a more or less distinct proper margin, and some with a distinct thalline margin, immediately or indirectly subpedicellate (*Roccellaceae*), sometimes roundish or circulate, the dominant form elongate or linear with a fissure-like (rimæform) disk, distinct (the greater part) or combined in a stroma; hypothecium generally dark and carbonaceous; paraphyses entire and free, or branching and interlacing; spores colorless or dark, of varying form and septation, the fusiform shape prevailing; spermatia in some genera not known, but not rare in *Arthoniaceae*, *Roccellaceae*, and *Dirinaceae*.



## KEY TO FAMILIES.

- Apothecia without margin..... **ARTHONIACEAE** (p. 17).  
 Apothecia margined (the margin rudimentary at times).  
   Thallus crustaceous.  
     Thallus ecorticate.  
       Apothecia separate..... **GRAPHIDACEAE** (p. 24).  
       Apothecia confluent in a stroma..... **CHIODECTONACEAE** (p. 26).  
     Thallus corticate above ..... **DIRINACEAE** (p. 27).  
   Thallus fruticose ..... **ROCELLACEAE** (p. 28).

**ARTHONIACEAE.**

Thallus crustaceous, uniform, with *Palmella* or *Chroolepus* algæ; apothecia round, oval, or linear, entire or branching, separate or confluent in a stroma (the latter state not occurring with us); paraphyses branching and connected; spermatia exobasidial.

## KEY TO GENERA.

- Thallus with *Palmella* gonidia..... **ALLARTHONIA** (p. 22).  
 Thallus with *Chroolepus* gonidia.  
   Spores parallel several locular..... **ARTHONIA** (p. 17).  
   Spores muriform..... **ARTHOTHELIUM** (p. 22).

**ARTHONIA** Ach.

Thallus crustaceous, thin, uniform or at the periphery approaching an effigurate state; apothecia immersed or sessile, roundish or irregularly stellate or elongated; paraphyses branching and mostly indistinct; asci pyriform, 8-spored; spermatia cylindric to elongate, straight or curved; spores bilocular to plurilocular.

## KEY TO SPECIES.

- Spores 2 or 3-locular.  
   Growing on earth; apothecia round..... 2. *A. glebosa*.  
   Growing on bark.  
     Apothecia round to ovoid or oblong.  
       Sessile on thallus..... 4. *A. galactitella*.  
       Innate in thallus..... 5. *A. rhoidis*.  
     Apothecia not roundish, more or less angular.  
       Brownish black..... 1. *A. microspermella*.  
       Bluish black..... 3. *A. subdispuncta*.  
 Spores 4 to 8-locular; growing on bark.  
   Thallus thick, whitish, pulverulent.  
     Apothecia some shade of brown; disk pruinose.  
       Entire or nearly so in outline.  
         Large..... 14. *A. impolita*.  
         Smaller..... 14a. *A. impolita chi-o-dectonoides*.  
       Not entire in outline.  
         Deeply sinuate..... 17. *A. polygramma*.  
         Less deeply sinuate..... 16. *A. gyalectoides*.  
   Thallus thin, smooth, some shade of gray.  
     Apothecia somewhat pruinose.  
       Medium large..... 9. *A. pruinosa*.  
       Very small..... 11. *A. subdiffusa*.



Spores 4 to 8-locular; growing on bark—Continued.

Thallus thin, smooth, some shade of gray—Continued.

Apothecia not pruinose.

Outline entire, round to roundish.

Large, prominent..... 7b. *A. radiata swartziana*.

Small, less prominent.

Not innate in thallus.

Crowded, black when moist..... 15. *A. lecanactidea*.

Not crowded.

Black when moist..... 12. *A. punctiformis*.

Gray when moist ..... 10. *A. diffusa*.

Innate in thallus..... 13. *A. epipastoides*.

Outline not entire.

Stellate-radiate..... 7. *A. radiata*.

Elongate-linear.

Conspicuously branching and curved.. 7a. *A. radiata angustata*.

Not conspicuously branching..... 8. *A. stictella*.

Not elongate, short-linear..... 6. *A. tetramera*.

#### 1. *Arthonia microspermella* Willey.

Thallus whitish or silver gray, thin, effuse; apothecia small, round or oblong, numerous, brownish black; asci oblong-ovoid to subglobular, 36 to 40  $\mu$  long, 18 to 20  $\mu$  thick; spores in 8's, colorless, 2 or 3-locular, 13 to 14  $\mu$  long, 4 to 4.5  $\mu$  thick; hymenial gelatine blue with iodine, the asci and contents yellow.

On *Juglans californica*, in canyons of the Santa Monica Mountains. A type specimen not being available for comparison, the determination of the Californian lichen is subject to correction.

#### 2. *Arthonia glebosa* Tuck.

Thallus thickish, of bullous, separate or connected and plicate, convex and rounded, pale dun colored squamules; apothecia black, roundish or oblong, convex, smooth, interspersed and becoming conglomerate between the thalline squamules; epithecium subcontinuous, light brown; thecium light brown, 48 to 52  $\mu$  high; hypothecium dark brown and thick; paraphyses intricately interwoven; asci subinflated-clavate, the membrane slightly thickened above, 36 to 38  $\mu$  long, 12 to 15  $\mu$  thick; spores in 8's, 12 to 16  $\mu$  long, 4 to 5  $\mu$  thick, bilocular, the upper loculus round or ovoid, the lower narrower and slightly longer; hymenial gelatine with iodine orange to copper brown.

A most singular-appearing *Arthonia*.

Mesas on earth. Collected by C. R. Orcutt in Lower California.

#### 3. *Arthonia subdispuncta* Nyl.; Hasse, Bull. Torrey Club 24: 448. 1897.

Thallus sordid white, subfarinaceous, effuse, hypothallus pale; apothecia bluish black, small, angular, oblong or irregularly round, about 0.1 mm. wide, sessile or subinnate; epithecium coarsely granulose, bluish gray; thecium colorless 28 to 30  $\mu$  high; paraphyses obscure; asci broadly spatulate to pyriform, 30 to 34  $\mu$  long, 16  $\mu$  thick; spores oblong-ellipsoid, bilocular, not constricted, attenuate at one end, the other end blunt, 11  $\mu$  long, 4  $\mu$  thick; hymenial gelatine with iodine pale yellow.

On caudex of *Leptosyne gigantea*; beach bluffs at Point Dume, Santa Monica Mountains. Type deposited in the U. S. National Herbarium; duplicate in herb. Hasse.

#### 4. *Arthonia galactitella* Nyl.

Thallus forming cream-colored spots, irregular in outline and 1 to 2 cm. wide, finely furfuraceous; apothecia numerous, small, slightly erumpent, flat, somewhat pruinose, round, or, as if by aggregation of several, oblong; asci oblong-ovate; membrane thick-



ened at apex, 32 to 44  $\mu$  long, 14 to 16  $\mu$  thick; spores in 8's, oblong-ellipsoid, 4-locular, not constricted, the upper loculus largest, the others equal in length, one end blunt, the other attenuated, 13 to 16  $\mu$  long, 5 to 5.2  $\mu$  thick; paraphyses absent; hymenial gelatine with iodine stained a coppery red.

On bark of apricot and oleander, Soldiers' Home grounds (near Santa Monica).

**5. *Arthonia rhoidis* Zahlbr. Beih. Bot. Centralbl. 13: 156. 1902.**

Thallus thin, effuse, pale pinkish; apothecia immersed, black, slightly pruinose, from punctiform to irregularly roundish or oblong; epithecium granulose, blackish with a bluish tinge; paraphyses coherent and interwoven; thecium 56 to 60  $\mu$  high, colorless; hypothecium pallid; asci 40 to 46  $\mu$  long, 12 to 18  $\mu$  thick; spores in 8's, oblong-ellipsoid, 3-locular, the two septa approximate near the middle of the spore, 13 to 14  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine and spore sacs with iodine a violet blue, the contents of the latter and the spores yellow to orange.

Type locality, Santa Catalina Island on bark of *Rhus laurina*. Type deposited with Dr. A. Zahlbruckner; duplicates in the U. S. National Herbarium and in herb. Hasse.

The writer has subsequently found this species on *Grevillea robusta* on the Soldiers' Home grounds and on *Salix lasiolepis* and *Platanus racemosa* in canyons of the Santa Monica Range. The thallus of the mainland form is whitish and smoother than the insular type, but spore measurements and chemical reaction are identical.

**6. *Arthonia tetramera* (Stizenb.).**

*Arthonia dispersa tetramera* Stizenb.; Hasse, Bull. South. Calif. Acad. 2: 35. 1903.

Thallus silvery white, thin, subfarinaceous, limited by a thin, black border; apothecia with a delicate, spurious thalline margin, linear and variously branching, numerous; epithecium finely granulose, bluish black; thecium 64 to 68  $\mu$  high, colorless; paraphyses indistinct; asci pyriform, 28 to 32  $\mu$  long, 12 to 16  $\mu$  thick; spores in 8's, oblong-ellipsoid, attenuate at one end, 4-locular, not constricted, the episporium thin, 11 to 14  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine blue, soon dark orange red; spermatogones not seen.

On *Lonicera subspicata*, Santa Catalina Island. Type specimen in herb. Hasse.

**7. *Arthonia radiata* (Pers.) Ach.**

Thallus mostly whitish to light gray, rarely pale cream or flesh color, consisting of smooth, indeterminate, irregular roundish patches from 3 to 4 or more centimeters in diameter; apothecia black, flat, appressed, more or less radiately lobed or divided; asci pyriform; spores in 8's, 4-locular, oblong-ellipsoid, 14 to 18  $\mu$  long, 5 to 7  $\mu$  thick; hymenial gelatine with iodine blue, then vinous red, the asci and spores yellow.

On various barks, common. Cosmopolitan.

**7a. *Arthonia radiata angustata* Wain.**

Apothecia linear, simple or branching, the thallus limited by a black hypothalline line; measurements and reactions as in the species.

On caudex of *Leptosyne gigantea*, on San Nicolas Island, *Trask*; on the smooth bark of *Quercus agrifolia* and *Heteromeles arbutifolia* in the Santa Monica Mountains.

**7b. *Arthonia radiata swartziana* (Ach.) Willey.**

Thallus whitish to gray, similar to the species; apothecia dull black and black, roundish, less distinctly radiate and more crowded, flat; epithecium granulose, dark gray; thecium colorless or sordid, 68 to 80  $\mu$  high; paraphyses indistinct; hypothecium pallid or grayish; asci pyriform, the membrane much thickened above, 44 to 60  $\mu$  long, 22 to 24  $\mu$  thick; spores oblong-ovoid, 4-locular, blunt at the ends, 16 to 20  $\mu$  long, 7  $\mu$  thick, with a halo; hymenial gelatine with iodine blue—including the hymenial structures (the spores yellow or pale orange).

On various barks, like the species widely distributed in southern California but less frequent.



**8. *Arthonia stictella* Stizenb.**

*Arthonia stictella* Stizenb.; Hasse, Bull. South. Calif. Acad. 2: 34. 1903, nomen nudum.

Thallus epiphloeodal, sordid whitish, subfurfuraceous; apothecia parallel, lirellate, black; thecium about 60  $\mu$  high, pallid; paraphyses intricate, indistinct; asci pyriform with a thick membrane, especially above, 60  $\mu$  long, 20  $\mu$  thick; spores in 8's, colorless, oblong, finger-shaped, both ends rounded, 6-locular, the loculi somewhat lenticular, 20 to 26  $\mu$  long, 6 to 7  $\mu$  thick; iodine staining the epithecium deep blue and the hymenial gelatine deep orange red; spermogones not seen.

On bark of *Lonicera subspicata*, Santa Catalina Island. Type in herb. Hasse.

**9. *Arthonia pruinosa* Nyl.; Hasse, Lich. South. Calif. 16. 1898.**

Thallus thick, epiphloeodal, white to pale cream color, of roundish patches 1.5 cm. or less wide, furfuraceous; spermatia straight, staff-shaped, 8 to 10  $\mu$  long, 1  $\mu$  thick; apothecia numerous, small, about 0.1 mm. wide, flat, round, black or mostly white pruinose; epithecium granulose, dark ashy gray; paraphyses indistinct; asci oblong-ovoid, 28 to 36  $\mu$  long, 12 to 16  $\mu$  thick, the membrane thick especially above; spores in 8's, oblong-ellipsoid, bilocular, not constricted, the episore thin, 13 to 16  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine pale vinous red, the contents of the asci yellowish.

On bark of *Cordia* sp., a small South American tree cultivated at the Agricultural Experiment Station near Santa Monica.

Type deposited with the late Dr. W. Nylander; duplicates in the U. S. National Herbarium, with Dr. A. Zahlbruckner, and in herb. Hasse.

**10. *Arthonia diffusa* Nyl.**

Thallus white, finely granulose or furfuraceous, epiphloeodal, diffuse; apothecia small (about 0.2 mm. wide), black, when moistened yellow gray and semitranslucent; epithecium granulose, gray, after iodine bluish gray; thecium colorless, 50 to 54  $\mu$  high; asci pyriform, 36 to 44  $\mu$  long, 14 to 18  $\mu$  thick, the upper part thickened; spores 4-locular, ovoid-oblong, 13 to 16  $\mu$  long, 3.5 to 4.5  $\mu$  thick; hymenial gelatine pale claret with iodine, the spores yellow.

On *Malvastrum fasciculatum*, in canyons of the Santa Monica Mountains.

**11. *Arthonia subdiffusa* Willey.**

Thallus whitish, thin, in small round or oblong maculae, 1 to 2 cm. wide, with KHO reddish yellow, with  $\text{Ca}(\text{ClO})_2$  unchanged; apothecia very minute, round or oblong, slightly projecting, black, flat, quite densely pruinose, very similar in appearance to those of *Allarthonia patellulata caesiocarpa* Zahlbr., the latter, however, round and convex; epithecium graphite color, subgranulose; thecium colorless, 40 to 44  $\mu$  high; hypothecium colorless; paraphyses distinct; asci oblong-ovoid, 40  $\mu$  long, 20  $\mu$  thick; spores in 8's, narrowly oblong-ovoid, 4-locular, the loculi equal, attenuate at one end, 16 to 18  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine pale vinous red, the spores yellow.

On *Malvastrum fasciculatum* in the Santa Monica Mountains.

**12. *Arthonia punctiformis* Ach.**

Thallus hypophloeodal, effuse, gray to dull reddish brown; apothecia black, plano-convex, round or oblong; asci ovoid-oblong, 48  $\mu$  long, 20  $\mu$  thick; spores in 8's, 4-locular, oblong-ellipsoid, 22 to 24  $\mu$  long, 7 to 8  $\mu$  thick, rounded at each end, narrowed at one end; reaction with iodine a dark vinous red.

On various smooth barks, widely distributed; Santa Cruz Mountains, *Herre*, San Bernardino, *Parish*; frequent in the Santa Monica Mountains.

**13. *Arthonia epipastoides* Nyl.**

Thallus epiphloeodal, silvery white, somewhat furfuraceous or minutely scaly, effuse; apothecia minute, punctiform, irregularly roundish or angular, impressed;



hypothecium colorless; asci ovoid,  $40\ \mu$  long,  $20\ \mu$  thick, the membrane thickened above; spores in 8's, oblanceolate, 2 or 3-locular, or mostly 4-locular, 20 to  $40\ \mu$  long, 6 to  $7\ \mu$  thick, straight or lightly curved, one end long-attenuate; asci with iodine pale violet, the spores yellow.

On California holly, walnut, and *Rhus laurina*, in canyons of the Santa Monica Mountains.

**14. *Arthonia impolita* (Ehrh.) Borr.**

Thallus white to silvery gray, effuse, moderately thick, pulverulent, KHO—;  $\text{Ca}(\text{ClO})_2$ +red; apothecia numerous, at times confluent, flesh-colored to light reddish brown, subinnate and sessile, flat, roundish, oblong, or even lobulate to wavy in outline, with a thin spurious thalline margin, somewhat pruinose, when moist tumid and light yellowish brown; epithecium yellowish gray or brownish and granulose; thecium colorless, 48 to  $52\ \mu$  high; paraphyses indistinct; hypothecium colorless; asci wedge-shaped,  $44\ \mu$  long,  $24\ \mu$  thick, the membrane thickened above; spores colorless, oblong-ovoid, 13 to  $20\ \mu$  long, 5.5 to  $8\ \mu$  thick, 4 to 5-locular, the extreme loculi slightly larger than the central; reaction with iodine blue, including the epithecium and hypothecium, changing to red brown, the ascus protoplasm and spores yellow.

Santa Catalina Island on California holly and walnut bark; on various barks on the mainland, Santa Monica Mountains; on shrubs at Newport and White Point near San Pedro.

**14a. *Arthonia impolita chiodectonoides* Tuck.**

Thallus white, creamy, furfuraceous, in rounded patches, 1.5 to 6.5 cm. wide, without a limiting black hypothallus; no reaction with iodine; apothecia small, roundish, often several congregated, dark flesh-colored, densely pruinose or covered by thallus; epithecium light yellowish gray, not granulose; thecium colorless, 40 to  $48\ \mu$  high; asci cuneate, 36 to  $40\ \mu$  long, 16 to  $20\ \mu$  thick, the membrane thickened above; spores in 8's, oblong-ovoid to oblong-ellipsoid, colorless, 4 or 5-locular, the end loculi slightly larger than the others.

Near Newport on the cortex of dead *Opuntia*; on shrubs at White Point near San Pedro.

In view of the differing reaction this might rank as a species.

**15. *Arthonia lecanactidea* Zahlbr. Beih. Bot. Centralbl. 13: 155. 1902.**

Thallus creamy white, epiphloeodal, effuse, medium thick, finely rimose; apothecia numerous, often crowded, dull black, planoconvex, slightly raised above the thallus, from 0.3 to 0.5 mm. wide; epithecium subgranulose, brownish dark gray; thecium 76 to  $80\ \mu$  high, colorless; paraphyses coherent, intricately interwoven; hypothecium pallid; asci cuneate,  $52\ \mu$  long,  $16\ \mu$  thick, the upper part thickened; spores in 8's, bilocular, oblong, the lower cell slightly attenuate, 10 to  $14\ \mu$  long, 3.5 to  $4\ \mu$  thick; hymenial gelatine with iodine pale violaceous, the spores light orange.

On *Lycium californicum*. Type locality, bluffs at White Point near San Pedro. Also collected on Santa Catalina Island on the same substrate, at the isthmus.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**16. *Arthonia gyalectoides* Muell. Arg.**

Thallus white, furfuraceous, slightly roughened or granular, effuse; apothecia 0.5 to 0.8 mm. wide, flesh-colored, flat or concave, roundish, somewhat flexuose in outline or quite irregular, white pruinose, appressed, surrounded by a slightly raised false thalline margin, the moistened disk paler and translucent; thecium colorless; epithecium granulose; thecium with epithecium  $60\ \mu$  high; hypothecium pallid; paraphyses indistinct; asci pyriform to balloon-shaped, about  $36\ \mu$  long,  $24\ \mu$  thick, the membrane thickened above; spores in 8's, ovoid-oblong, rounded at both ends, attenuate toward one end, 5-locular, the upper loculus the larger, 16 to  $22\ \mu$  long, 7 to  $8\ \mu$  thick;



hymenial gelatine with iodine blue, soon vinous red, the spores becoming pale yellow; thallus with KHO—,  $\text{Ca}(\text{ClO})_2$ +red.

Santa Catalina Island on California holly and walnut; canyon of Santa Monica Mountains on *Quercus agrifolia*.

**17. Arthonia polygramma** Nyl.

Thallus white, thin, effuse, subfurfuraceous, KHO+ yellow, then reddish,  $\text{Ca}(\text{ClO})_2$ —; apothecia brown, innate, flat or slightly concave, pruinose, irregularly round or oblong in outline, deeply radiately incised (as seen better when moist, the pruina then transparent), and reddish brown; epithecium granulose, yellowish gray; thecium about  $60\ \mu$  high, colorless to a pale brownish hue; hypothecium brownish yellow; asci balloon-shaped, the membrane thickened above; spores in 6's (?), ovoid-oblong, rounded at both ends, 5 or 6-locular, 16 to  $23\ \mu$  long, 6 to  $8\ \mu$  thick, the epispore thick, the end cells, especially the upper, larger than the middle ones; paraphyses indistinct; hymenial gelatine with iodine a rich reddish brown.

Santa Catalina Island on *Rhus diversiloba*; on oak bark, Santa Cruz Mountains, Herre.

**ALLARTHONIA** Nyl.

Thallus with *Palmella* gonidia; otherwise as in *Arthonia*.

**1. Allarthonia patellulata** (Nyl.) Zahlbr. in Engl. & Prantl. Nat. Pflanzenfam. 1<sup>1\*</sup>: 91. 1907.

*Arthonia patellulata* Nyl. in Nya Bot. Notis. 1853: 95. 1853.

Thallus pale cream color, effuse, continuous, epiphloeodal; apothecia round or slightly oblong, black, small, appressed or slightly projecting; asci ovoid or oblong-ovoid, 32 to  $36\ \mu$  long,  $20\ \mu$  thick, the upper part of the membrane thickened; spores in 8's, bilocular, oblong and constricted, 12 to  $15\ \mu$  long, 4 to  $5\ \mu$  thick, the loculi equally parted but the lower narrower and somewhat attenuate; hymenial gelatine blue with iodine, also the ascus membrane, but contents and spores yellow.

On *Malvastrum fasciculatum*, Santa Monica Mountains.

**1a. Allarthonia patellulata caesiocarpa** (Zahlbr.).

*Arthonia patellulata caesiocarpa* Zahlbr. Bull. Torrey Club 27: 646. 1900.

Thallus thin, white; apothecia pruinose; hypothecium pale; "spores 15 to  $17\ \mu$  long, 5.5 to  $6\ \mu$  thick."

Type locality, Sepulveda Canyon, Santa Monica Mountains, on the same host as the species.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse

**ARTHOTHELIUM** Mass.

Differs from the genus *Arthonia* only in having muriform spores.

KEY TO SPECIES.

- |   |                             |
|---|-----------------------------|
| Apothecia pruinose, round or nearly so..... | 3. <i>A. pruinascens</i> .  |
| Apothecia not pruinose.                     |                             |
| Dark red or brown.....                      | 4. <i>A. sanguineum</i> .   |
| Black.                                      |                             |
| Round or oval.                              |                             |
| Grouped in circles.....                     | 1. <i>A. orbiliferum</i> .  |
| Not grouped in circles.....                 | 2. <i>A. taediosum</i> .    |
| Irregularly or indistinctly radiate.....    | 5. <i>A. anastomosans</i> . |

**1. Arthothelium orbiliferum** Almq.

Thallus whitish to leaden gray, smooth, thin, epiphloeodal in roundish patches without a limiting black line, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia round, small, black, flat, disposed in a more or less interrupted circle; epithecium bluish black, nongranu-



lose; paraphyses indistinct (not well defined); asci pyriform, the membrane thickened above; spores 6 to 8, oblong-ovoid, 21 to 27  $\mu$  long, 10 to 15  $\mu$  thick, muriform, colorless, with 6 transverse septa and 2 or 3 in the longitudinal spore axis, one or both end cells divided into 2 or 3 triangular cells; spermogones marked by a minute black projection; sterigma simple, straight; spermatia acicular, straight, 6 to 8  $\mu$  long and about 1  $\mu$  thick; with iodine the ascus membrane staining vinous red, the spores yellow, the other thecial structures blue.

Santa Catalina Island on California holly; also on the mainland (Santa Monica Mountains) on the same host and on wild walnut.

## 2. *Arthothelium taediosum* Nyl.

Thallus smooth, thin, white to light grayish, limited by an indistinct black line, KHO+yellow, Ca(ClO)<sub>2</sub>—; apothecia black, innate, irregularly substellate or oblong-roundish in outline, when moistened a little erumpent and under the lens internally reddish brown; paraphyses not sharply defined; asci pyriform, 56 to 68  $\mu$  by 24 to 48  $\mu$ , the upper part thickened; spores 6 to 8, muriform, colorless, oblong-ellipsoid, 24 to 32  $\mu$  long, 11 to 15  $\mu$  thick, with transverse septa and 2 or 3 in the long spore axis, the extreme cells divided into 2 or 3 parts; reaction with iodine blue, the ascus membrane pale vinous red, the spores yellow.

In the Santa Monica Mountains on bark of *Platanus racemosa*, also on *Juglans californica* and *Heteromeles arbutifolia*; on *Rhus diversiloba*, at Highland Park near Pasadena.

## 3. *Arthothelium pruinascens* Zahlbr. Bull. Torrey Club 27: 646. 1900.

Thallus sordid whitish, rugulose, determinate but irregularly spreading; apothecia innate to sessile, white-pruinose, round to oblong, flat; paraphyses not sharply defined; thecium light yellowish brownish, about 80  $\mu$  high; asci balloon-shaped, 72 to 75  $\mu$  long, 36  $\mu$  thick, the upper part much thickened; hypothecium yellow; spores in 8's, colorless, broadly oblong-ellipsoid, muriform, 18 to 22  $\mu$  long, 7 to 12  $\mu$  thick; transverse septa 7 with 3 or 4 in the long spore axis; iodine staining epithecium, thecium, and hypothecium a deep blue, the ascus membrane pale vinous red and the spores yellow.

Type locality Sepulveda Canyon, Santa Monica Mountains. On *Malvastrum fasciculatum*. Occasionally also on the bark of *Ceanothus divaricatus* and other barks.

## 4. *Arthothelium sanguineum* (Willey) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 91. 1907.

*Arthonia sanguinea* Willey, Syn. Arth. 22. 1890.

Thallus milk white, effuse, subfurfuraceous, epiphloeodal, KHO+yellow, Ca(ClO)<sub>2</sub>—; apothecia appressed, dark red brown, convex, erumpent, round or oblong, in the juvenile state white pruinose; epithecium sordid yellowish; thecium about 60  $\mu$  high; hypothecium colorless; asci pyriform with a thick membrane, 40 to 52  $\mu$  long, 20 to 24  $\mu$  thick; spores colorless, ovoid-oblong, 20 to 30  $\mu$  long, 14 to 20  $\mu$  thick; reaction with iodine blue, the spores pale scarlet; spermogones marked by a black punctiform projection, sterigma short, straight; spermatia staff-shaped, straight, 6 to 10  $\mu$  long, 1  $\mu$  thick.

## 5. *Arthothelium anastomosans* (Ach.) Nyl.

Thallus white or silvery gray, smooth or lightly rugulose, epiphloeodal, determinate, in rounded patches without a black hypothalline border; apothecia small, black, innate, irregularly stellate or indistinctly radiate, epruinose or finely white pruinose at the margin; epithecium yellowish brown, not granulose; thecium 48 to 52  $\mu$  high, colorless or with a faint yellow hue; paraphyses not sharply defined; hypothecium colorless; asci balloon-shaped, 40  $\mu$  long, 36  $\mu$  thick, the upper part of membrane thickened; spores in 8's, ovoid, colorless, muriform, 18 to 22  $\mu$  long, 9  $\mu$  thick, mostly with 5 transverse septa and 3 faint ones in the long spore axis, the end cells irregularly



about 3-septate; ascus membrane staining a pale vinous red with iodine, the spores rich yellow, the other thecial structures blue.

On *Platanus* and *Heteromeles* in the Santa Monica Mountains and on oak bark on Santa Catalina Island.

### GRAPHIDACEAE.

Thallus crustaceous, attached to the substrate by medullary hyphæ; gonidia consisting of *Palmella* or *Chroolepus*; apothecia normally elongated, not combined in a stroma, with a proper margin; disk rimæform; paraphyses simple, branched or unbranched, generally distinct.

Only one genus as yet found within our limits.

### OPEGRAPHA Humb.

Apothecia with a proper margin, innate, appressed or sessile, mostly elongate, lirellæform; disk rimæform or slightly dilated; hypothecium dark or pallid; paraphyses branched and intertwining; asci clavate or oblong; spores in 8's, ovoid, oblong to fusiform, colorless, parallel-plurilocular with cylindric cells; sterigma simple; spermatia oblong, straight or curved.

Our species belong to the section *Euopegrapha* Muell. Arg., the margin brittle, carbonaceous, continuous with the hypothecium (as seen on a transverse section of an apothecium).

#### KEY TO SPECIES.

- Substratum rock; thallus white..... 1. *O. chevallieri*.  
 Substratum bark.  
   Spores 4 or 5-locular.  
     Apothecia small.  
       Straight or curved ..... 9. *O. umbellulariae*.  
       Ovate..... 2. *O. atra lichenoides*.  
     Apothecia larger.  
       Oblong ..... 3. *O. prosiliens*.  
       Linear, straight ..... 4. *O. atrorimalis*.  
   Spores 6-locular.  
     Apothecia small.  
       Round to ellipsoid..... 5. *O. pulicaris*.  
       Numerous, round to oblong and linear..... 8. *O. vulgata*.  
     Apothecia larger.  
       Linear-elongate ..... 6. *O. rimalis*.  
       Fusiform, acute, black..... 7. *O. diaphora*.

#### 1. *Opegrapha chevallieri* (Leight.).

*Opegrapha saxicola chevallieri* Leight. Lichenfl. Brit. ed. 3. 402. 1879.

Thallus white, furfuraceous, moderately thick, continuous to finely rimose, bordered by a thin black line, KHO—, Ca(ClO)<sub>2</sub>+red; apothecia black, straight or curved, flexuose, mostly crowded and even contiguous; epithecium rimæform or slightly dilated and then flat, black, under the microscope brown black, less dark than the hypothecium; thecium 80  $\mu$  high, dingy white, with iodine stained a deep orange; spores in 8's, ellipsoid, 12 to 14  $\mu$  long by 3.5 to 4  $\mu$  thick.

Newport Bluffs on sandstone; Santa Catalina Island on argillaceous rock.

#### 2. *Opegrapha atra lichenoides* Pers.

Only the forma *chlorina* Jatta represented in our area.

Thallus pale, dingy yellowish greenish, smooth; apothecia small, ovate to roundish, the proper margin finally nearly obsolete and the disk greenish-pruinose; epithecium granulose, greenish brown to dark brown; thecium 88 to 90  $\mu$  high, colorless, with iodine



dark orange; paraphyses interwoven; hypothecium reddish brown; asci clavate to oblong-ellipsoid; spores in 8's, fusiform, colorless, 24 to 28  $\mu$  long, 6 to 7  $\mu$  thick, 5-locular; after application of KHO surrounded by a halo.

On *Umbellularia californica*, Malibu Canyon, Santa Monica Mountains.

**3. Opegrapha prosiliens** Stirton.

Thallus thin, sordid pale yellowish gray, in small oval patches; hypothallus indistinct; epithecium subcontinuous, a narrow black border; thecium colorless, 80  $\mu$  high; hypothecium pale brown to brown; paraphyses branching, loosely interwoven; asci clavate, 72  $\mu$  long, 20  $\mu$  thick; spores in 8's, ellipsoid with a broad, distinct halo, 20 to 26  $\mu$  long, 6 to 7  $\mu$  thick, 4-locular, the two end cells smaller than the two central; with iodine the thecium and asci staining yellow, the epithecium and hypothecium dark brown.

On dead *Lycium californicum* near Newport, Orange County.

**4. Opegrapha atrorimalis** Nyl.

Thallus sordid pale yellowish, determinate by a thin blackish hypothalline border; apothecia sessile, simple, straight, linear; thecium rimæform; epithecium granulose, pallid, yellowish gray to brown; thecium pallid, 64 to 80  $\mu$  high; paraphyses laxly coherent; hypothecium brown to blackening; asci inflated-clavate, 44 to 60  $\mu$  long, 16 to 22  $\mu$  thick, the membrane slightly thickened above; spores bluntly fusiform or oblong-ovoid, 20 to 24  $\mu$  long, 6 to 9  $\mu$  thick, with a thin halo, 4-locular; hymenial gelatine with iodine brownish yellow.

On various smooth barks in the Santa Monica Range.

**5. Opegrapha pulicaris** (Hoffm.) Nyl.

Thallus whitish to dirty white; apothecia small, ovoid to ovoid-ellipsoid, simple; disk slightly dilated; epithecium granulose, sordid whitish; thecium 60 to 64  $\mu$  high, pallid; asci cylindric, about 60  $\mu$  long by 14  $\mu$  thick; spores fusiform, 24 to 28  $\mu$  long, 4 to 5  $\mu$  thick, 6-locular; hymenial gelatine with iodine pale yellowish red.

Santa Catalina Island on bark of *Rhus integrifolia*, and frequent in the Santa Monica Range on various barks.

**6. Opegrapha rimalis** Pers.

Thallus thin, sordid whitish, indeterminate; apothecia linear-elongate, small; epithecium sordid yellowish; thecium dingy white, 88  $\mu$  high; hypothecium dark brownish black; hymenial gelatine with iodine vinous red; spores fusiform, 20 to 28  $\mu$  long, 5 to 6  $\mu$  thick, 6-locular.

On various barks on Santa Catalina Island and the mainland.

**7. Opegrapha diaphora** Ach.

Thallus pale ash-colored, furfuraceous, epiphloeodal, continuous or becoming rimose; apothecia black, fusiform and acutish, the proper margin narrow, shining, some with a spurious thalline margin; disk flat, black; epithecium thin, yellowish black, paler than the hypothecium, gradually paling downward; thecium 92 to 96  $\mu$  high, colorless, staining with iodine orange to vinous red, the stain darkest in the lower part, the epithecium assuming a violaceous tint; paraphyses coherent and interwoven; hypothecium dark yellowish black; asci clavate, nearly equaling the thecium; spores 8, fusiform, 20 to 24  $\mu$  long, 5 to 6  $\mu$  thick; spermogones indicated by minute black dots; spermatia short, rod-shaped, slightly curved, 3 to 4  $\mu$  long, 1 to 1.5  $\mu$  thick.

On exposed roots of *Rhus integrifolia*, beach bluffs at White Point, near San Pedro.

**8. Opegrapha vulgata** Ach.

Thallus creamy white, effuse; apothecia numerous, small, roundish to oblong, linear, simple; epithecium rimæform; thecium colorless or pale yellow, 80 to 82  $\mu$  high; paraphyses branched and loosely interwoven; hypothecium deep brown black; asci subcylindric, 44 to 50  $\mu$  long, 14 to 18  $\mu$  thick; spores narrowly fusiform, 6-locular



the loculi equal, 16 to 24  $\mu$  long, 3.5 to 4  $\mu$  thick; hymenial gelatine with iodine reddish orange to a rich red brown.

Bark, Santa Catalina Island, *Trask*; on *Lycium californicum*, near Newport, Orange County; on bark of *Quercus agrifolia*, in the Santa Monica Range.

**9. Opegrapha umbellulariae** Zahlbr. Beih. Bot. Centralbl. 13: 154. 1902.

Thallus whitish, smooth, continuous to delicately rimose, forming small roundish, epiphloeodal patches; apothecia small, black, straight or curved, simple or at times forked, linear-ellipsoid; disk rimæform to slightly dilated; epithecium black, carbonaceous; thecium 74  $\mu$  high; hypothecium pallid; hymenial gelatine with iodine blue soon changing to yellow and orange; spores in 8's, colorless, oblong, the ends blunt, 13 to 15  $\mu$  long by 4  $\mu$  thick, 4-locular, slightly constricted at points of septation.

On *Umbellularia californica*. Type locality, Malibu Canyon, Santa Monica Mountains.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

### CHIODECTONACEAE.

Thallus crustaceous, uniform, attached to the substrate by hypothalline or medullary hyphæ, ecorticate (in our genera), with Chroolepus gonidia; apothecia in stromata, mostly immersed, orbicular or elongate, with a dark or colorless proper margin; paraphyses simple, free or branched and reticulate; spores parallel-multilocular, the loculi cylindric (in our genera); spermatia cylindric, elongated to elliptic, straight or curved.

#### KEY TO GENERA.

- Spores colorless..... CHIODECTON (p. 26).  
 Spores dark..... SCLEROPHYTON (p. 27).

### CHIODECTON Ach.

Apothecia variously shaped, from round and oblong to linear and stellate; proper exciple well developed, brittle, dark or rudimentary; hypothecium similar to the exciple; paraphyses branching, interwoven; spores fusiform to acicular or oblong, colorless, parallel-multilocular.

**1. Chiodecton ochroleucum** Zahlbr. Bull. Torrey Club 27: 646. 1900.

"Thallus tenuis, effusus, inaequalis vel subrugulosus, tartareus, ochroleucus, KHO flavens, Ca(ClO)<sub>2</sub> erythrinus, medulla alba. I vinosa fulvescenti. Gonidia chroolepoidea, cellulis ellipsoideis vel oblongis, concatenatis. Pocadostromata thallo immersa vel rarius demum modica prominale, irregulariter oblonga, usque 1 mm. vel parum ultra longa, niveo-pruinosa. Hymenia stellata, substellata, elongata, vel plus minus flexuosa, apicibus obtusis, humectata mollia et turgescientia, ochracea, margine diaphana, intus pallida, I vinosa-rubescientia. Hypothecium et epithecium pallidum (lutescens). Paraphyses tenues, filiformes, connexo-ramosae. Asci ovali-cuneati, 8-spori, 53-62  $\mu$  longi et 20-22  $\mu$  lati. Sporae ovaes vel ovali-oblongae, hyalinae, transversim 4-5 septatae, cellulis cylindricis, 14-18  $\mu$  longi et 8  $\mu$  latae, episporio tenui. Receptacula pycnoconidiorum punctiformia, nigra, nitida, immersa, excepto vertice; sterigmatibus basi ramosis, cellulis superioribus subinflatis, longioribus, subfasciculatis; pycnoconidiis filiformibus, arcuatis, 11-18  $\mu$  in diam. et 1.5-1.8  $\mu$  latis."

"Species distincta, a *Chiodectone californica* Tuck. hymenio pallido et sporis minoribus latioribusque distat."

On bark of *Rhus integrifolia*, Santa Catalina Island, *Trask*.



**SCLEROPHYTON** Eschw.

Differs from the genus *Chiodecton* only in having dark spores.

**1. Sclerophyton californicum** (Tuck.).

*Chiodecton californicum* Tuck. Syn. N. Amer. Lich. 2: 135. 1888.

Thallus "pale ochroleucous," thickly crustaceous, darkening with age; apothecia numerous, crowded, the thecial structure composed of a stroma of several apothecia surrounded by a turgid, persistent, thalline margin; disk dull black but densely pruinose and thus concolorous with the thallus, from round to angular and variously difform; thallus at the circumference inclining to become lobular and limited by a dull black hypothalline border; with  $\text{KHO}$ —,  $\text{Ca}(\text{ClO})_2$ +red, the medulla—; epithecium subgranulose and but little darker than the thecium; thecium  $140\ \mu$  high, pale sordid yellow giving no reaction with iodine; paraphyses interwoven, slender; hypothecium dark brown; asci clavate, thick-walled; spores in 8's, oblong-ellipsoid with blunted ends, brown, 6 to 8-locular, the cells cylindric, the spores 20 to  $30\ \mu$  long and 5 to  $7\ \mu$  thick.

Near Newport on *Lycium californicum* and on shrubs near San Diego at Point Loma; Santa Catalina Island at the "isthmus" on *Rhus integrifolia*.

**DIRINACEAE.**

Thallus crustaceous, uniform, attached to the substrate by hyphæ of the medullary layer; gonidia *Chroolepus*. Apothecia round or elongated with a proper and a thalline margin; hypothecium dark; spores parallel several-locular.

**DIRINA** Fries.

Paraphyses simple, unbranched; asci 8-spored, colorless, oblong or fusiform; spermogones immersed; spermatia arcuate.

The only genus representing the family in our district. Our species growing on bark.

**KEY TO SPECIES.**

Hymenial gelatine with iodine yellow..... 1. *D. hassei*.

Hymenial gelatine with iodine vinous red..... 2. *D. rediunta*.

**1. Dirina hassei** Zahlbr. Bull. Torrey Club 27: 644. 1900.

Thallus effuse, crustaceous, furfuraceous, finely rugulose, pale creamy whitish; apothecia small, numerous, sessile; disk planoconvex, dark, thickly pruinose, with an entire, thin, persistent thalline margin; epithecium light yellowish, granulose; thecium colorless, 76 to  $80\ \mu$  high, staining with iodine a rich yellow; paraphyses thin, entire, coherent; hypothecium brown; asci oblanceolate or subsaccate, 60 to  $64\ \mu$  long, 10 to  $12\ \mu$  thick; spores fusiform, colorless, slightly curved, obtuse, 4-locular, 16 to  $20\ \mu$  long, 4 to  $5\ \mu$  thick.

On bark of *Rhus laurina*. Type locality, beach near Santa Monica. The species occurs also on Santa Catalina Island on the bark of *Heteromeles arbutifolia*.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**2. Dirina rediunta** (Stizenb.) Zahlbr. in litt.

*Lecanora rediunta* Stizenb.; Hasse, Bull. Torrey Club 24: 446. 1897.

Thallus crustaceous, whitish to cream colored, effuse, smooth, continuous to finely rimose, epiphloeodal,  $\text{KHO}$ + light yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, dispersed or at times crowded, small, 0.5 mm. wide; disk black, planoconvex, thickly white-pruinose with a thin, persistent, entire thalline margin; epithecium granulose, dark; thecium pale yellowish, 96 to  $112\ \mu$  high, with iodine vinous red; paraphyses coherent; asci clavate, 64 to  $68\ \mu$  long by  $10\ \mu$  thick; spores fusiform, colorless, straight or lightly curved, blunt, 20 to  $26\ \mu$  long, 4 to  $6\ \mu$  thick, 4 to 11-locular.



Type locality, Santa Catalina Island. On *Heteromeles arbutifolia*; also on bark of *Juglans californica* and other barks in the Santa Monica Mountains.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

### ROCCELLACEAE.

Thallus fruticulose, erect, attached by a basal disk; cortical and medullary layers distinct, with *Chroolepus* gonidia; apothecia round, lirellæform, or deeply lobed, innate or sessile.

#### KEY TO GENERA.

Cortical hyphæ parallel to thalline surface; apothecia round. DENDROGRAPHA (p. 28).  
Cortical hyphæ vertical to thalline surface.

Apothecia round..... ROCCELLA (p. 28).

Apothecia deeply lobed; spores dark..... SCHIZOPELTE (p. 29).

### DENDROGRAPHA Darbish.

Differing from *Roccella* only in the fact that the cortical hyphæ are parallel with the thalline surface instead of vertical to it.

#### KEY TO SPECIES.

Main trunks compressed, stout..... 1. *D. leucophaea*.

Main trunks not compressed, slender..... 2. *D. minor*.

#### 1. *Dendrographa leucophaea* (Tuck.) Darbish.

Thallus fruticulose, erect, densely branching, the main trunks compressed, the branches and branchlets terete, smooth, becoming finely attenuate, light yellowish gray and darkening to dull brown gray; apothecia numerous, mostly on the lower compressed portion of the thallus, sessile or subpedicellate, the disk circular, convex, dark, thickly pruinose, the thalline margin entire, persistent; epithecium pale yellowish gray, granulose; thecium colorless, 130 to 140  $\mu$  high, stained yellow with iodine; paraphyses loose, branched and forked below the tips, interwoven, the scarcely thickened apices not colored; hypothecium dark brown black, thick; asci sub- $\beta$ -flated-clavate, the membrane thick, not colored by iodine but the contents yellow; spores fusiform-ellipsoid with blunt ends, straight or lightly curved, colorless, 20 to 27  $\mu$  long, 5 to 7  $\mu$  thick, 4-locular; spermogones numerous, sterigma straight, entire, forked, with acicular, hook-shaped or curved spermatia 12 to 16  $\mu$  long.

Santa Catalina Island, *Trask*; on *Lycium californicum* near San Pedro; Newport; on *Pinus torreyana* at Del Mar, near San Diego; Lower California.

#### 2. *Dendrographa minor* (Tuck.) Darbish.

Thallus fruticulose, slender, intricately branched, the basal disk rudimentary, the small trunk little if at all compressed, about 3 to 4 cm. high; soredia frequent but apothecia thus far not found.

On maritime rocks, rarely on shrubs, at San Francisco, *Herre*, and San Diego, *Orcutt*; frequent at Newport on rocks and occasional on shrubs; on rocks on Santa Catalina Island, and doubtless at other stations along the coast.

### ROCCELLA Lam. & DC.

Thallus fruticulose, erect, loosely branching, compressed or subterete; hyphæ of cortex vertical to thalline surface, with *Chroolepus* gonidia; basal disk corticate or ecorticate; soredia frequent; apothecia lateral, sessile, round with a black or decolorate proper margin and encircled by a thalline one; hypothecium black; paraphyses branching; asci 8-spored; spores colorless, oblong-fusiform, parallel 4-locular; spermatia staff-shaped, arcuate.



## KEY TO SPECIES.

Growing on rock.

Thallus compressed..... 1. *R. fuciformis*.

Thallus terete..... 3. *R. tinctoria*.

Growing on bushes..... 2. *R. fucoides*.

**1. *Roccella fuciformis* (L.) Lam. & DC.**

Thallus erect, fruticulose, dull whitish or grayish, glaucescent, compressed, sparingly dichotomously divided below into long-attenuate, flattish, narrow, ribbon-like segments, KHO—,  $\text{Ca}(\text{ClO})_2$ +red, 5 to 10 cm. high; apothecia sessile, flat, pruinose, of the same color as the thallus, marginal and lateral with a persistent, entire or finely crenulate thalline margin, this finally becoming flexuose, the disk now and then almost difform and denuded, dark and roughened; epithecium granulose, yellowish gray, gradually paling downward; thecium colorless, 100 to 136  $\mu$  high, with iodine pale yellow; paraphyses slender, branching; hypothecium black brown; asci clavate and subinflated-clavate, membrane thick, 76  $\mu$  high, 18  $\mu$  thick; spores colorless, straight or lightly curved, 4-locular, 20 to 28  $\mu$  long by 5 to 7  $\mu$  thick; spermatia acicular, arcuate and hook-shaped.

On rocks, Santa Catalina Island, *Trask*; Point Loma near San Diego, on shrubs. North and South America, East Africa, Asia Minor, and Europe.

**2. *Roccella fucoides* (Dicks.) Wain.**

“Thallus coriaceous, terete-compressed, dwarfish, dichotomously at length much branched, whitish ash colored, often sorediferous; spores 12 to 16  $\mu$  by 3 to 4  $\mu$ .”

A plant thus described is reported from San Diego (Tuck.) “growing on bushes, etc.”

**3. *Roccella tinctoria* (L.) Lam. & DC.**

“Thallus coriaceous, terete, but often more or less flattened and pale, dull; sparingly branched but much elongated and intertangled; apothecia middling to ample, sessile, disk flattish, black, equaling or excluding the margin. Spores fusiform-oblong, 20 to 26  $\mu$  by 5 to 8  $\mu$ .” (Tuckerman.)

Reported by Mr. C. R. Orcutt<sup>1</sup> from San Diego.

North and South America, Asia, Europe, and Africa.

**SCHIZOPELTE T. Fries.**

Thallus erect, forked, the branches terete; apothecia terminal; disk irregularly incised or parted; hypothecium black; paraphyses branching; spores fusiform, brown, 3-locular.

**1. *Schizopelte californica* T. Fries.**

Thallus whitish (becoming cream-colored in herb.), terete, erect, fruticulose from a fasciculate tuft, distantly branching or furcate above, finely furfuraceous, with cephalodia, from 3 to 7 cm. high, KHO—,  $\text{Ca}(\text{ClO})_2$ +red; apothecia terminal and lateral, subpedicellate, oblique, irregularly lobed to flexuose and deeply lobed and difform; disk dull black, thinly pruinose, flattish to concave; thalline margin persistent and here and there coarctate; epithecium dark brown black, subgranulose; thecium about 100  $\mu$  high, dingy yellow with iodine; asci oblong-cylindrical, 72  $\mu$  long, 18  $\mu$  thick; spores in 8's, longitudinally or diagonally disposed, 18 to 24  $\mu$  long, 5 to 7  $\mu$  thick, brown, oblong, 4 to 7-locular, the end cells a little larger than the others.

On San Clemente Island, *Trask*; on rocks, Santa Catalina Island.

**Suborder CYCLOCARPINEAE.**

Large subdivision presenting all thalline forms from the crustaceous to the foliose and fruticulose; likewise all algæ known to form symbiosis with fungal hyphæ represented, this an important systematic character; apothecia for the greater part open or

<sup>1</sup> Fl. South. & Low. Calif. 12. 1885.



discoid, sessile upon or immersed in the thallus and thalline warts, or occurring distinctly pedicellate; exciple (outer covering or margin) well developed, though wanting in a few genera; apothecium either *biatorine* (the exciple soft in texture and pallid in color), *lecideine* (the exciple dark, black, and brittle, horny, or carbonaceous), or *lecanorine* (the exciple surrounded by a margin having the characters of the thallus); hypothecium (a continuation of the proper margin beneath the thecium or hymenium) partaking of the character of the margins in the forms of apothecia mentioned; paraphyses simple or branched, free or reticulately connected, without or with septa, their tops often thickened and colored, or the paraphyses closely adglutinated by hymenial gelatine; asci permanent, 1 to many-spored; spores 1-celled (simple), or variously partitioned, bilocular, polari-bilocular (a form of the bilocular, with the loculi (cells) more or less separated, being situated mostly at the poles of the spore and connected by a central tube (isthmus), this, however, sometimes absent), or muriform-multilocular, colorless or brown; sterigma variously formed, endobasidial or exobasidial.

## KEY TO FAMILIES.

Spores bilocular or polarilocular, colorless or brown.

Spores colorless, polarilocular.

Thallus crustaceous, uniform or lobed at periphery..... **CALOPLACACEAE** (p. 110).

Thallus foliaceous or fruticulose..... **TELOSCHISTACEAE** (p. 116).

Spores brown, 2 to 4-locular or muriform.

Thallus crustaceous, uniform or lobate at periphery..... **BUELLIACEAE** (p. 118).

Thallus foliaceous or fruticose..... **PHYSICIACEAE** (p. 127).

Spores simple, several locular or muriform, rarely colored.

Thallus gelatinous when moist, homoömerous, the algæ blue green.

Gonidia Scytonema or Stigonema algæ..... **EPHEBACEAE** (p. 70).

Gonidia Nostoc algæ, apothecia discoid..... **COLLEMACEAE** (p. 71).

Gonidia Gloeocapsa algæ; apothecia urn-shaped or discoid..... **PYRENOPSISIDACEAE** (p. 68).

Thallus not gelatinous when moist.

Thallus terete, more or less erect or pendent.... **USNEACEAE** (p. 105).

Thallus not terete.

Thallus crustaceous, uniform or lobed.

Gonidia Protococcus..... **DIPLOSCHISTACEAE** (p. 33).

Gonidia Chroolepus or Phyllactidium algæ..... **LECANACTIDACEAE** (p. 31).

Gonidia bright yellow green Pleurococcus or Palmella algæ.

Asci 1 to 8-spored, seldom 16 or more spored; apothecial margin pale and soft or dark and brittle.

Apothecia with lecanorine margin.... **LECANORACEAE** (p. 85).

Apothecia not lecanorine.

Not sunken in thallus.

Sessile..... **LECIDEACEAE** (p. 34).

Pedicellate..... **CLADONIACEAE** (p. 57).

Sunken in thallus..... **PERTUSARIACEAE** (p. 84).

Asci many-spored; apothecia lecanorine,

biatorine, or lecideine..... **ACAROSPORACEAE** (p. 62).



Spores simple, etc.—Continued.

Thallus not gelatinous when moist—Continued.

Thallus squamulose or foliose.

Apothecia affixed by entire under surface.. **PELTIGERACEAE** (p. 82).

Apothecia sessile or pedicellate.

Apothecia pedicellate upon podetia..... **CLADONIACEAE** (p. 57).

Apothecia not on podetia.

Medullary hyphæ absent or obsoles-

cent; algæ *Scytonema*..... **HEPPIACEAE** (p. 75).

Medullary hyphæ present.

Spores fusiform, several-locular;

thallus with cyphels..... **STICTACEAE** (p. 82).

Spores ovoid to ellipsoid, simple,

rarely bilocular.

Gonidia *Scytonema* algæ..... **PANNARIACEAE** (p. 79).

Gonidia *Pleurococcus* or *Parmella*  
algæ.

Apothecia lecanorine; thallus

foliaceous..... **PARMELIACEAE** (p. 99).

Apothecia not lecanorine, most-

ly lirellate; thallus mostly

monophyllous..... **GYROPHORACEAE** (p. 59).

### LECANACTIDACEAE.

Thallus crustaceous, uniform, with *Chroolepus* gonidia; apothecia circular, sessile or innate, having a distinct or rudimentary proper margin, naked; paraphyses branching and more or less reticulate; spores several-locular, colorless, with cylindrical loculi and a thin spore membrane; spermatia exobasidial.

#### KEY TO GENERA.

Proper margin wanting or rudimentary; apothecia naked,

with a lecanorine margin ..... **SCHISMATOMMA** (p. 32).

Proper margin well developed, black, carbonaceous, con-

tinuous with the hypothecium..... **LECANACTIS** (p. 31).

### LECANACTIS Eschw.

Thallus crustaceous, uniform, attached to the substrate by the hypothalline or medullary hyphæ, ecorticate, without rhizine; gonidia *Chroolepus*; apothecia innate, adnate, or sessile, circular, lecideine, with a carbonaceous proper margin, the lecanorine margin absent; hypothecium black, carbonaceous, continuous with the proper margin; paraphyses loose, branching, loosely interwoven; asci 4 to 8-spored; spores colorless, oblong, fusiform to acicular, parallel-bilocular to multilocular, the loculi cylindric; spermatia oblong to cylindric.

#### KEY TO SPECIES.

Apothecia circular, densely pruinose..... 1. *L. salicina*.

Apothecia often oblong or irregular, less densely pruinose..... 2. *L. californica*.

#### 1. *Lecanactis salicina* Zahlbr.; Hasse, Bryologist 11: 7. 1906.

Thallus, thin, effuse, finely scaly-furfuraceous, silvery gray with at times a faint yellowish tinge, KHO—, Ca(ClO)<sub>2</sub>—; epithecium fine-granulose, pale yellowish gray; thecium colorless, 70 to 72  $\mu$  high, staining yellow with iodine; paraphyses lax, loosely branching and interwoven; hypothecium dark brown black; asci clavate, nearly equaling the thecium in height; spores in 8's, colorless, fusiform, straight or lightly



curved 4-locular, 28 to 36  $\mu$  long, 4 to 6  $\mu$  thick, one end long-attenuate, the two end cells longer than the two central; apothecia sessile, round, from 0.3 to 0.5 mm. wide, the flat, densely white-pruinose disk surrounded by a thin, black, crenulate proper margin, markedly contrasting with the pruinose disk when moistened, the pruina disappearing later and the disk then black and planoconvex.

Type on *Salix lasiolepis*, Rustic Canyon in the Santa Monica Mountains.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

## 2. *Lecanactis californica* Tuck.

Thallus whitish cream-colored, furfuraceous, minutely areolate to verrucose; determinate, with a black hypothalline border, KHO+ light yellow, Ca(ClO)<sub>2</sub>—; apothecia sessile, round to angular or oblong and (rarely) even to broadly lirellate; disk flat to convex, whitish pruinose or epruinose and black, the persistent proper margin black, crenulate, carbonaceous; epithecium subcontinuous, yellowish brown; thecium colorless, 74 to 80  $\mu$  high; paraphyses loose, some forked once or twice below the clavate-thickened grayish apices; hypothecium dark brown black, carbonaceous; asci clavate, extending upward to the colored epithecium; spores colorless, in 8's, 24 to 28  $\mu$  long, 5 to 6  $\mu$  thick, fusiform, blunt-ended, 4-locular, straight or mostly a little curved; with iodine the epithecium and upper part of thecium reacting blue, the lower part with ascus membranes and spores a rich yellow.

Widely distributed over our district on various barks, but mostly found in proximity to the coast. Santa Catalina Island, Newport, Santa Monica Mountains, Del Mar, San Diego, etc.

## SCHISMATOMMA Flot. & Koerb.

Differing from *Lecanactis* in having a turgid lecanorine margin surrounding the apothecia, the spores also generally more narrowly fusiform; spermatia acicular, straight or curved.

### KEY TO SPECIES.

Growing on bark.

Spores 10 to 14-locular ..... 1. *S. pluriloculare*.

Spores 4-locular ..... 3. *S. californicum*.

Growing on rock ..... 2. *S. hypothallinum*.

1. *Schismatomma pluriloculare* Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 116. 1907.

*Platygrapha plurilocularis* Zahlbr. Beih. Bot. Centralbl. 13: 156. 1902.

Thallus crustaceous, epiphloeodal sordid whitish, pulverulent, subverruculose, rimulose, limited by a black hypothalline border, KHO—, Ca(ClO)<sub>2</sub>+reddish; apothecia sessile, numerous and generally crowded, with a prominent, turgid, coarsely crenulate, now and then difform, lecanorine margin, giving the apothecia an urceolate appearance; disk flat, black; epithecium granulose, pale dingy yellow grayish to pale brown; thecium not quite colorless to pale brownish, 84 to 88  $\mu$  high, staining yellow with iodine; paraphyses coherent, interwoven, some forked above, not thickened or colored at the tips; hypothecium dark brown black; asci broadly ellipsoid, 88  $\mu$  long, 26  $\mu$  thick, the membrane somewhat gelatinous; spores in 6's or 8's, fusiform, colorless, 48 to 52  $\mu$  long, 4 to 6  $\mu$  thick, 10 to 14-locular, the loculi somewhat unequal, the spores straight or lightly curved; spermogones acicular, lightly curved, 16 to 20  $\mu$  long, less than 1  $\mu$  thick.

On *Rhus integrifolia*. Type locality, Santa Catalina Island. It has also been found on Santa Barbara Island by Mrs. Blanche Trask.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

## 2. *Schismatomma hypothallinum* (Zahlbr.).

*Platygrapha hypothallina* Zahlbr. Bull. Torrey Club 27: 645. 1900.

Thallus white, mealy, thick, effuse, convolute-rugulose, KHO—, Ca(ClO)<sub>2</sub>+ red; apothecia innate and sessile, round, often crowded and then irregularly round or



difform; disk flat to convex, white-pruinose, surrounded by a thick thalline margin; epithecium brownish, gradually paling downward; thecium pale sordid yellowish to brownish, 86 to 100  $\mu$  high, stained a dark red by iodine; paraphyses coherent and closely interwoven; hypothecium dark brown black; asci oblong, subcylindric, reaching to the colored epithecium; spores in 8's, fusiform, colorless, 24 to 30  $\mu$  long, 4 to 5  $\mu$  thick, with a gelatinous halo, 8-locular, the loculi equal in length.

Type from Santa Catalina Island on calcareous rock, *Trask*. San Clemente Island, same collector; on the mainland near Newport on sand rock.

Type deposited with Dr. A. Zahlbruckner, of Vienna; duplicates in the U. S. National Herbarium, with Dr. A. C. Herre, and in herb. Hasse.

### 3. *Schismatomma californicum* (Tuck.) Herre in litt.

*Dirina californica* Tuck. Lich. Calif. 17. 1866.

Thallus whitish ash-colored, rugose, effuse; apothecia sessile, crowded; disk black and thickly white-pruinose, surrounded by a turgid, wavy or crenulate thalline margin; epithecium granulose, pale to brownish; thecium colorless, stained blue by iodine; paraphyses closely coherent and intricate; hypothecium thick, dark brown black; asci clavate; spores dactyliform, 4-locular, 15 to 19  $\mu$  long, 3 to 4  $\mu$  thick.

Sparingly in the Santa Monica Mountains on *Quercus agrifolia*.

## DIPLOSCHISTACEAE.

Thallus crustaceous, uniform, subverruculose; apothecia round, immersed or appressed; disk generally small, concave to flat, surrounded by a proper and a lecanorine margin; paraphyses simple or forked above; asci 4 to 8-spored, the spores muriform, dark; gonidia recognised as *Protococcus*.

The family is represented with us only by one genus.

### DIPLOSCHISTES Norm.

#### KEY TO SPECIES.

Disk sessile, broadly concave, black.

Medulla with iodine blue..... 1. *D. scruposus*.

Medulla with iodine giving no reaction..... 2. *D. gypsaceus*.

Disk immersed, small, brown..... 3. *D. actinostomus*.

#### 1. *Diploschistes scruposus* (L.) Norm.

Characters as above. Thallus light gray to dark ash color, areolate-rimose and verruculose, the surface pulverulent, KHO—; Ca(ClO)<sub>2</sub>+red, the medulla also red, with iodine the medulla staining blue; apothecia innate, small to large (1.5 mm.); disk concave to flattish, dull black, more or less whitish pruinose, the proper margin darker than the disk, surrounded by a persistent thalline margin; epithecium brown; thecium colorless, 80 to 84  $\mu$  high; hypothecium sordid whitish, no reaction of the hymenial gelatine with iodine; spores brown, 4 to 8 in asci, muriform, oblong-ellipsoid, the transverse septa 5 or 6 with 1 to 3 fainter ones in the longitudinal spore axis; spore wall slightly contracted at points of septation, 28 to 36  $\mu$  long, 14 to 16  $\mu$  thick.

Cosmopolitan. Frequent throughout our territory. On earth or earth-covered rocks. Santa Cruz Mountains, *Herre*; San Diego, *Orcutt*; San Bernardino, *Parish*; Santa Monica Mountains; Santa Catalina Island.

The species is somewhat changeable according to the different hosts. In the variety *bryophilus* Ach. the thallus is whitish, thinner, and less rugulose. Over-running mosses and *Cladoniae*. In the variety *parasiticus* Sommerf., the thallus is obsolete or disappearing. In both varieties the apothecia are smaller than in the type. These forms occur occasionally in the Santa Monica range growing over *Cladonia pyxidata* and *C. tubaeformis*.



**2. *Diploschistes gypsaceus* (Ach.).***Urceolaria gypsacea* Ach. Lich. Univ. 338. 1810.

Thallus cretaceous white, pulverulent. Differs from *D. scruposus* in having somewhat larger spores and mainly in the absence of amyloid reaction of the medulla with iodine.

On dry sterile clay soil near Elsinore and on Santa Catalina Island.

**3. *Diploschistes actinostomus* (Pers.) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 122. 1907.***Verrucaria actinostoma* Pers.; Ach. Lich. Univ. 288. 1810.

Thallus indeterminate, areolate-rimose to diffract, light to dark ash gray, the areoles becoming verrucose, containing one to several apothecia, KHO—; with iodine the medulla blue; apothecia immersed, flattish to subglobose, small, the proper margin brown to darker, finely radiate-striate; epithecium continuous to subcontinuous, grayish brown; thecium colorless, about 140  $\mu$  high, staining yellow with iodine; paraphyses slender, intricate, not septate nor branched, slightly clavate at the apices; hypothecium colorless; asci cylindric; spores roundish and obovoid, light grayish blue becoming brown, muriform with 3 or 4 transverse septa and 1 or 2 in the long spore axis, 18 to 27  $\mu$  long, 10 to 18  $\mu$  thick.

On various rocks in the Santa Monica Mountains; Santa Cruz Peninsula, *Herre*.

**LECIDEACEAE.**

Thallus crustaceous, ranging from uniform to variously lobed, and to squamulose or rimose, rarely approaching the fruticose form; gonidia of the thallus bright green, belonging to the genus *Protococcus*; apothecia generally sessile, surrounded by a proper margin, this, like the hypothecium, pallid and waxy or dark (black) and horny, containing no gonidia, the thalline margin absent; asci containing from 1 to 8, rarely more, spores, these colorless or colored, entire or variously septate; spermatia ellipsoid or staff-shaped.

**KEY TO GENERA.**

Thallus crustaceous.

Paraphyses not branched, strict, coherent or distinct.

Spores simple, colorless..... LECIDEA (p. 34).

Spores compound.

Spores 2-celled (bilocular)..... CATILLARIA (p. 48).

Spores parallel 4 celled to pluricellular, thin-walled, the cells (loculi) cylindric..... BACIDIA (p. 50).

Paraphyses branched, lax; spores 2-celled or muriform-

multicellular, decolorate to dark ..... RHIZOCARPON (p. 55).

Thallus verrucose, squamulose, or microphylline..... TONINIA (p. 53).

**LECIDEA Ach.**

Thallus effigurate or uniform; apothecia circular or when crowded varying to angular, flexuose or even oblong, sessile or subsessile; proper margin and hypothecium from pallid and waxy to dark and horny; disk pale to black; paraphyses not branched; spores 8, rarely more, colorless, simple, globular, ovoid or oblong, thin-walled; spermatia staff-shaped or acicular, straight or curved.

**KEY TO SECTIONS.**

Thallus uniform.

Apothecial margin and hypothecium brittle, dark..... 1. EULECIDEA.

Apothecial margin and hypothecium not brittle, pale or dark... 2. BIATORA.

Thallus not uniform.

Squamulose to squamose, lobed more or less..... 3. PSORA.



## KEY TO SPECIES.

Section 1. **EULECIDEA** T. Fries.

Substratum bark.

- Thallus smooth, gray..... 20. *L. euphorea*.  
 Thallus not smooth, squamulose to whitish gray..... 15. *L. elabens*.

Substratum rock.

Thallus obsolete.

Proper margin (exciple) black.

- Sinuate; disk opaque, black..... 6. *L. diducens*.  
 Crenate; disk velvety black..... 9. *L. vorticosa*.

Proper margin (exciple) gray and fissured..... 7. *L. cinerata*.

Thallus present.

Thallus squamulose.

Squamules dark brown to black.

- Approximate..... 1. *L. atrobrunnea*.  
 Not approximate..... 4. *L. fumosa*.

Squamules lighter colored.

Light brown.

- Polished, bright chestnut brown.... 2. *L. protabacina*.  
 Not polished, light brown..... 3. *L. fuscatoatra*.

Not light brown.

Yellowish.

- Grayish yellow to fawn color.... 13. *L. atrolutescens*.  
 Pale ochroleucous, mealy..... 5. *L. hassei*.

Some shade of gray.

- Well developed..... 10. *L. platycarpa*.  
 Not well developed..... 11. *L. lithophila*.

Thallus not squamulose.

Thallus globular-verrucose.

Verrucæ whitish to grayish.

- Pale ash color..... 8. *L. lapicida*.  
 Whitish..... 18. *L. enteroleuca*.

Verrucæ pale yellow.

Thallus giving no reaction with

- KHO..... 12. *L. brandegei*.

Thallus with KHO+yellow.

Thalline verrucæ globular.

- Crenate or sublobulate..... 17. *L. catalinaria*.  
 Not crenate nor sublobulate. 18c. *L. enteroleuca pilularis*.

Thalline verrucæ flattened.

- Light gray..... 18b. *L. enteroleuca aequata*.

Not gray.

- Light yellow..... 16. *L. latypaea*.  
 Cream color..... 18a. *L. enteroleuca theioplaca*.

Thallus not globular-verrucose.

Granulose and disappearing, sordid within..... 19. *L. goniophila*.

Rimose-areolate, gray.

- Proper margin (exciple) conspicuous... 14. *L. plana*.  
 Proper margin (exciple) less conspicuous..... 21. *L. tessellata*.



Section 2. **BIATORA** T. Fries.

Substratum rock or earth.

Thallus not squamulose or only indistinctly so.

Pulverulent, light gray to sordid white, or obsolete. 29. *L. phaeophora*.Furfuraceous to indistinctly squamulose..... 32. *L. coarctata*.

Thallus squamulose.

Squamules small, not imbricate..... 35. *L. subplebeia*.

Squamules larger.

Peripheral squamules radiate..... 33. *L. granulosa phyllizans*.Peripheral squamules not radiating..... 22. *L. glebulosa*.

Substratum bark.

Thallus uniformly granulose, not becoming verruculose.

Light yellowish greenish..... 24. *L. querneae*.Dusky greenish gray..... 26. *L. viridescens*.

Thallus granulose to verruculose.

Thallus when present of some shade of brown.

Of an ordinary brown..... 34. *L. xanthococcoides*.Dull brown or deficient..... 30. *L. myriocarpoides*.

Thallus not brown.

Sordid white; apothecia brown black..... 31. *L. turgidula*.

Not white, gray of some shade.

Apothecia brown.

Light brown, flattened, grouped..... 23. *L. varians*.Rusty brown, not flattened..... 27. *L. vernalis*.

Apothecia blackening.

Dark brown to dull black..... 25. *L. fuscescens*.Black; margin (exciple) crenate to flexuose..... 28. *L. flexuosa*.Section 3. **PSORA** (Hall.) T. Fries.

Substratum wood or bark; thallus squamulose, the squam-

ules dusty brown or deficient..... 38. *L. friesii*.

Substratum mineral.

Substratum rock.

Squamules large, cervine brown, polished..... 41. *L. rubiformis*.

Squamules small.

Dark brown to black..... 42. *L. rufonigra*.Red brown..... 43. *L. scotopholis*.

Substratum earth.

Squamæ pink red..... 40. *L. crenata*.

Not pink, red brown to brown.

Apothecia minute, central on squamæ..... 37. *L. luridella*.

Apothecia large.

Situating near border of squamæ..... 39. *L. decipiens*.

Not near border of squamæ, central.

Apothecia globular..... 36. *L. globifera*.Apothecia not globular, flat..... 44. *L. lurida*.1. **Lecidea atrobrunnea** (Ramond) Schaer.

Thallus determinate, chestnut brown to darker, squamulose-areolate; squamules in our species mostly approximate or contiguous, lobulate or flexuous and concave to undulate and convex, glistening, the border blackening; apothecia sessile, the



disk flat or flattish-convex, black, with a thin, entire proper margin slightly paler than the disk; epithecium subgranulose; thecium colorless; paraphyses strict, coherent, some of them abruptly capitate above; hypothecium yellowish to brown; asci inflated-clavate, nearly as high as the thecium; spores in 8's, elongate-ellipsoid, 8 to 11  $\mu$  by 3 to 4  $\mu$ .

San Fernando Valley, Los Angeles County, at 300 meters altitude; Yosemite Valley at 2,000 meters; San Bernardino Mountains, Prospect Ridge near Seven Oaks, 2,300 meters; Tehachapi Mountains near Lone Pine Mine, at 1,350 meters; San Gabriel Canyon, Los Angeles County, at 1,350 meters.

**2. *Lecidea protabacina* Nyl.; Hasse, Bull. South. Calif. Acad. 2: 60. 1903.**

Thallus crustaceous, of reddish brown, approximate (mostly) or scattered, turgid, strongly convex, smooth, shining squamules, rounded, or angular by pressure, occasionally fissured and lobulate, darkening at the border and beneath, KHO—, Ca(ClO)<sub>2</sub>—; hypothallus black; apothecia sessile, single or several grouped, 0.5 to 2 mm. wide; disk black, smooth, glistening, slightly to strongly convex, the thin, smooth proper margin becoming gradually obscure; epithecium a thin, bluish black line; paraphyses strict, closely coherent; thecium 44 to 48  $\mu$  high, almost colorless at the center of the disk, dark at the circumference, and indistinguishable from the thick, dark brown hypothecium; hymenial gelatine stained blue with iodine; asci narrowly clavate; spores in 8's, oblong-ellipsoid, 11 to 12  $\mu$  by 4 to 5  $\mu$ .

A handsome lichen conspicuous by its chestnut brown patches from 3 to 6 cm. in diameter, on granite in the higher mountains. Type locality, Mount San Antonio, San Gabriel Range, at 3,300 meters; at the same elevation on Tauquitz Peak, San Jacinto Mountains; on San Bernardino Peak at 3,700 meters altitude.

Type deposited with Doctor Nylander; duplicates in the U. S. National Herbarium and in herb. Hasse.

**3. *Lecidea fuscatoatra* Nyl. sp. nov. in litt.**

Thallus crustaceous, determinate, of approximate, brown squamules, slightly concave to undulate and becoming convex, round-angular or lobulate, the hypothallus indistinct; KHO—, Ca(ClO)<sub>2</sub>—; apothecia subinnate or appressed, the disk dull black, flat to convex, round-angular or sinuate, the proper margin slightly lighter in color than the disk, thin, persistent, entire or crenulate and sinuate, subcarbonaceous; epithecium continuous, bluish black or brown black; thecium colorless, 90 to 92  $\mu$  high; paraphyses strict, coherent, not all clavate at the blunt, bluish tips; hypothecium brown, as dark as the epithecium and thicker than the thecium; hymenial gelatine blue with iodine, the stain extending into the hypothecium; asci clavate; spores in 8's, oblong linear ellipsoid, 8 to 12  $\mu$  long, 3 to 4  $\mu$  thick. Neither KHO nor NO<sub>3</sub> produces change in the colors of the thecial structures.

On granite rocks. Type locality, "Martin's Camp," San Gabriel Range, at 1,600 meters altitude. Has been collected in the Santa Cruz Mountains at 400 meters, *Herre*. Occurs at Camp Baldy, San Antonio Canyon, Los Angeles County, at 1,500 meters.

Type deposited with Doctor Nylander in 1898; duplicates in the U. S. National Herbarium and in herb. Hasse.

**4. *Lecidea fumosa* (Hoffm.) Ach.**

Thallus crustaceous, determinate, brown to blackish brown, squamulose; squamules small, flat, round, 0.5 to 0.75 mm. in diameter, scattered, to larger, approximate, and subimbricate, undulate and with a sinuate border; hypothallus distinct, black, giving to the naked eye an almost black surface to the lichen; apothecia appressed and sessile; disk black, flat, indistinctly pruinose or mostly naked, soon strongly convex, the thin black margin finally obscured; epithecium dark brown to bluish black, granulose, gradually paling downward; thecium colorless or pale bluish grayish, 68 to 70  $\mu$  high, staining blue with iodine; paraphyses strict, closely coherent, brown black at the apices; hypothecium dark brown; asci broadly ellipsoid and saccate,



about 50 to 60  $\mu$  long and 14 to 20  $\mu$  thick; spores in 8's, broadly ellipsoid, 8 to 16  $\mu$  long, 5 to 8  $\mu$  thick.

Frequent and of wide range both as to latitude and altitude.

On granite, San Gabriel Mountains, and on trap (Topanga Canyon at 160 meters altitude, Santa Monica Range); Santa Cruz Mountains near Mansfield at 70 meters and Black Mountain at 2,600 meters, *Herre*; Yosemite Valley at 1,600 meters; Matilija Canyon, Ventura County; Santa Catalina Island: San Fernando Valley; San Jacinto Mountains at 2,600 meters. North and South America, Africa, Asia, and Europe.

**5. *Lecidea hassei* Zahlbr. Ann. Mycol. 10: 374. 1912.**

"Thallus crustaceus, uniformis, epilithicus, ad 0.4 mm. crassus, subtartareus, effusus, areolato-diffractus, passim verruculoso-inaequalis, lutosocinerascens, opacus, KHO—,  $\text{Ca}(\text{ClO})^2$  dilute aurantiacus, in margine bene limitatus, sed linea obscuriore non cinctus, ecorticatus; medulla, alba, ex hyphis non amylaceis formata; gonidiis pleurococcoideis.

"Apothecia sessilia, dispersa vel conferta, usque 2 mm. lata, e rotundato anguloso-irregularia, sinuoso-incisa vel subgyrosa, nigra, primum urceolata, demum subplana; disco opaco, epruinoso; margine crassiusculo, bene prominulo, demum leviter depresso, nitidulo, ex integro flexuoso; perithecio ex hyphis radiantibus formato, extus nigro, intus pallidiore, crassiusculo, KHO—, J violaceocoeruleo; epithecio insperso nigro, KHO vix mutato (in fusum vergente),  $\text{NO}_5$ —; hymenio fere decolore, angusto, 45–55  $\mu$  alto, in hypothecium sensim abeunte, J e coeruleo lutescente; hypothecio crassiusculo, subcinnamomeo-cinerascente, KHO rosaceo, ex hyphis dense intricatis, ad superficiem disci plus minus perpendicularibus formato, J persistenter violaceocoeruleo; paraphysibus filiformibus, 1.5–1.8  $\mu$  crassis, conglutinatis, simplicibus, eseptatis, ad apicem capitato-clavatis; ascis hymenio subaequilongis, cylindrico-clavatis vel oblongo-clavatis, ad rotundatis et membrana modice incrassata cinctis, 8-sporis; sporis in ascis biserialibus, decoloribus, simplicibus, bacillari-oblongis, ad apices rotundatis, membrana tenuissima cinctis, 10–12  $\mu$  longis et 2–3.5  $\mu$  latis.

"Conceptacula pycnoconidiorum immersa, subglobosa, vertice nigro emergentia; fulcris exobasidialibus; pycnoconidiis bacillaribus, utrinque rotundato-retusis, rectis (rare suberectis), basidiis longioribus, 6–8  $\mu$  longis et ad 1  $\mu$  latis.

"Habituell sich der *Lecidea auriculata* Th. Fr. nähernd, gehört sie dennoch nicht in den Formenkreis dieser Spezies; eher wäre sie in der Gruppe der *Lecidea sarcogynoides* Koerb. einzureihen."

On sandstone at Ballona Bluffs near Santa Monica and Verdugo Mountains near Los Angeles.

**6. *Lecidea diducens* Nyl.**

Thallus obsolescent or quite obsolete; identical with *L. hassei* Zahlbr. in the varying characters and reactions of the apothecial structures and spores; irregularities of the proper margin often more marked than in the preceding species; at times a spurious thalline margin present, strongly fissured, simulating *Lecidea cinerata* Zahlbr. somewhat; in juvenile apothecia the margin coarctate; spores as in the last preceding species.

This is more frequent than *L. hassei* on rocks from lower levels to the summits of the higher ranges. Santa Monica Mountains, on trap and sandstone at 250 meters and lower; Tehachapi Mountains at 1,600 meters on granite; Del Mar on sandstone at 35 meters; Mount Wilson, San Gabriel Range, at 2,000 meters, on granite; in the Santa Cruz Mountains at 800 meters and higher, *Herre*.

**7. *Lecidea cinerata* Zahlbr. Bull. Torrey Club 27: 644. 1900.**

Thallus absent; apothecia more or less congregated, small, not over 1 mm. wide, round, angular, and sinuous, the margin prominent and coarctate; disk concave to flat, black, at first lightly pruinose; epithecium yellowish to blackish; thecium



colorless; paraphyses slender, entire, coherent, at the tips olivaceous brown; asci clavate; spores in 8's, colorless, simple, 12 to 14  $\mu$  long, 5 to 7  $\mu$  thick.

On disintegrated granite in the Santa Monica Range above Hollywood, the type locality. At Big Rock, the eastern base of the San Gabriel Range, at 1,600 meters.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**8. *Lecidea lapicida* Fries.**

Thallus medium thin, of a clear light ash color, finely rimose-areolate, the areolae slightly concave to flat, becoming lightly convex, or angulose and almost diffract, not stained with KHO; sterigmata short, straight, 6 to 8  $\mu$  long; apothecia dull black, innate, roundish to slightly angular; disk flat with a very thin, black proper margin, later becoming convex, pruinose, the margin sinuate and the disk lobed, the margin then obscure; epithecium bluish black or brown; thecium colorless, 80  $\mu$  high, with iodine blue turning sordid brown; paraphyses stout, subcoherent with abruptly capitate, brown or bluish black tips; hypothecium faint yellowish grayish; asci oblong clavate and subinflated clavate; spores in 8's, bluntly ellipsoid, 12 to 15  $\mu$  long, 6 to 7  $\mu$  thick.

On granite and other hard crystalline rocks, quite frequent, ascending from middle elevations; Santa Cruz Mountains, *Herre*; Topanga Canyon, Santa Monica Range, at 250 meters; San Antonio Canyon, San Gabriel Range, at 1,600 meters; Elsinore; Matilija Canyon, Ventura County; Tehachapi Mountains, at 1,800 meters. Throughout North America and Europe.

**9. *Lecidea vorticosa* (Floerke) Koerb.**

Thallus in our district absent; apothecia sessile, the disk velvety black, from concave to flat and at last slightly convex, the proper margin persistent, black, crenulate; epithecium dark blue, subgranulose; thecium about 44  $\mu$  high, pale bluish gray, with iodine blue; paraphyses strict, coherent; hypothecium dark; spores in 8's, oblong, ellipsoid or almost linear, 8 to 11.5  $\mu$  long, 4 to 5  $\mu$  thick.

On disintegrated granite at Shoemakers Ranch, Big Rock Creek, 1,600 meters altitude, at the northeastern (desert) base of the San Gabriel Range.

**10. *Lecidea platycarpa* Ach.**

Thallus crustaceous, thin, indeterminate, light gray, furfuraceous, indistinctly rimose, becoming obsolete; hypothallus indistinct; apothecia dispersed, small, 0.3 to 1 mm. wide, sessile, round; disk flat, with an entire or slightly crenulate, black proper margin, this almost disappearing as the disk becomes convex; hypothecium slightly horny, obscurely brown; epithecium brown, subcontinuous; thecium colorless; paraphyses strict, coherent, with clavate, bluish black tips; asci clavate; spores ellipsoid, 16 to 20  $\mu$  long, 7 to 10  $\mu$  thick.

On sandstone, Santa Cruz Mountains, *Herre*; Grand Canyon, Arizona. May be found in our limits.

**11. *Lecidea lithophila* (Ach.) T. Fries.**

Thallus poorly developed, of small, thin, scattered, whitish to pale olivaceous squamules having a thin whitish pulverulent border; apothecia sessile, round, small, from 0.3 to 0.8 mm. wide; disk dull black, when moistened indistinctly brownish, flat to lightly convex, greenish pruinose, round with a thin, entire, black margin later becoming obsolete; epithecium continuous, brown; thecium colorless or faintly grayish tinted, with iodine blue, 80 to 92  $\mu$  high; paraphyses strict, subcoherent; hypothecium pale brown to almost colorless; asci inflated-clavate; spores rarely seen, ellipsoid, 9 to 15  $\mu$  long, 5 to 7  $\mu$  thick; with  $\text{NO}_5$  the epithecium becoming carmine red and purple.

On sandstone, Santa Cruz Mountains, *Herre*. A similar lichen is found in the southern part of the State, but being without spores can not be positively determined.



**12. *Lecidea brandegei* Tuck.**

Thallus crustaceous, pale dingy yellowish, determinate, rimose-areolate, the areolæ convex, round, oblong or angular, now and then lobate; hypothallus black, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia appressed, medium large (0.5 to 1.5 mm. wide), dull black; disk primarily flat with a semiturgid, prominent, dark grayish, entire or finely crenulate, now and then sinuate proper margin, later convex and the margin darker, becoming obscured; epithecium continuous, bluish black or grayish brown; thecium colorless, about  $76\ \mu$  high; paraphyses strict, moderately loosely coherent, clavate above, not septate nor branched; hypothecium light brown, paler than the epithecium; asci clavate; spores in 8's, rarely seen, ovoid-ellipsoid, 6 to  $9\ \mu$  long, 4 to  $5\ \mu$  thick; thecium stained deep blue with iodine.

On granite at Camp Baldy, at 1,500 meters altitude, in San Antonio Canyon, Los Angeles County; in Tahunga Canyon at a like elevation. "Rocky Mountains, Colorado," Brandege (Tuckerman).

**13. *Lecidea atrolutescens* Nyl.; Herre, Proc. Washington Acad. Sci. 12: 84. 1910.**

Thallus crustaceous, squamulose, light yellowish grayish to fawn color, imbricated or somewhat scattered, flat to lenticular, round or flexuose, naked or thinly whitish pruinose, the border whitish and crenulate, attached to the substrate by medullary hyphæ, KHO—,  $\text{Ca}(\text{ClO})_2$ —; hypothallus indistinct; apothecia sessile, scattered or crowded to conglomerate, 0.75 to 2 mm. wide; disk dull black, in age pruinose, with a raised, somewhat turgid, regular or mostly wavy margin, the disk becoming finally strongly convex and the persistent margin deeply sinuate; epithecium continuous, sordid dark grayish brown, gradually paling downward; thecium colorless to pale ash gray, 80 to  $84\ \mu$  high; paraphyses coherent, slightly clavate above and colored at the tips, not septate nor forked; hypothecium grayish yellowish, paler than the epithecium, much higher than the thecium; asci clavate and subinflated-clavate; spores in 8's, oblong-ellipsoid or ovoid-ellipsoid, 12 to  $16\ \mu$  long, 5 to  $8\ \mu$  thick; iodine staining epithecium, thecium, and hypothecium intensely blue; no changes with KHO; with  $\text{NO}_3$  the epithecium stained violet blue and in part obscurely a dark rose color; spermatogones not seen.

On granite at Martins Camp, Mount Wilson, at 1,600 meters altitude (the type locality); at Camp Baldy, San Antonio Canyon, at 1,500 meters.

Type deposited with Doctor Nylander; duplicate in herb. Hasse. Collected at Grizzly Peak, Santa Cruz Mountains, by A. C. Herre.

**14. *Lecidea plana* Lahm.**

Thallus crustaceous, thin, finely rimose-areolate, often obsolete, gray, the hypothallus black, indistinct, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia small to medium-sized, adnate, variously angulose to round-lobed; disk concave to plane, black, often with a faint reddish tinge, the margin persistent, prominent; epithecium brownish; thecium 60 to  $67\ \mu$  high; paraphyses strict, simple, the separated apices brownish gray; asci narrowly clavate; hypothecium pale brownish; spores narrowly oblong-ellipsoid,  $11\ \mu$  long,  $3\ \mu$  thick; hymenial gelatine dark blue with iodine.

On Sandstone, Santa Monica Range, near the Soldiers' Home; on same substratum near Newport, Orange County. Not heretofore reported from North America. Norway, England, and Germany.

**15. *Lecidea elabens* Fries.**

Crust effuse, whitish or darkening to ash gray, granulose to areolate-rimose, the areolæ verrucose or minutely rugulose, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia numerous, crowded, 0.25 to 1.25 mm. in diameter, closely sessile; disk black, with a thin, entire, brownish black margin, later becoming convex to subglobose, somewhat rugulose, and the margin excluded; epithecium sooty brown, paling downward; thecium colorless to light reddish brown; paraphyses coherent; hypothecium pallid to color-



less; asci clavate, nearly equaling the thecium in height; spores linear-oblong, subfusiform, 8 to 13  $\mu$  long, 2 to 4  $\mu$  thick, diagonally or longitudinally disposed; thecium with iodine blue, the epithecium with  $\text{NO}_3$  reddish.

On dead pine wood, Tehachapi Mountains, at 1,600 meters altitude; bark of *Pseudotsuga macrocarpa* in the San Gabriel Mountains at a like elevation; dead wood and fence boards, Santa Cruz Mountains, at 1,000 meters, *Herre*. New England States; middle and northern Europe.

#### 16. *Lecidea latypaea* Ach.

Thallus of pale, whitish or light ash-colored, small, round, semiglobular or flattish verrucæ, these scattered or congregated,  $\text{KHO}+$  yellowish,  $\text{Ca}(\text{ClO})_2-$ ; hypothallus absent; apothecia closely or somewhat deeply appressed, the disk black, mostly flat, round to irregularly angulose or lobulate, finally convex, the margin thin, concolorous or brownish or grayish black, not crenulate, but following the irregularity of the disk and finally obscured; epithecium continuous or subgranulose, bluish black to brownish; thecium colorless to grayish, about 80  $\mu$  high, stained intense blue with iodine, especially in upper part; paraphyses free to loosely coherent, the tips bluish black; hypothecium yellowish brown to brown, thick; with  $\text{KHO}$  the epithecium light brown, the hypothecium yellowish; asci clavate or subinflated clavate, 48 to 52  $\mu$  long, 20  $\mu$  thick; spores in 8's, broadly ellipsoid, often with one or two globules that disappear after  $\text{KHO}$ , 10 to 16  $\mu$  long, 5 to 12  $\mu$  thick; spermatia not seen ("arcuate, acicular").

Widely dispersed; on sandstone, Santa Monica Mountains; calcareous rock, Santa Catalina Island; Santa Cruz Mountains at Laguna Creek, *Herre*. Eastern and middle United States; Europe; northern Asia.

#### 17. *Lecidea catalinaria* Stizenb.; Hasse, Bull. Torrey Club 24: 447. 1897.

*Lecidea catalinaria* Stizenb.; Hasse, Lich. South. Calif. 14. 1896, nomen nudum.

Thallus yellow, verruculose, the verrucæ distinctly separate, congregated or dispersed, round, smooth, or sometimes larger, then oblong and obscurely lobulate,  $\text{KHO}+$  yellow,  $\text{Ca}(\text{ClO})_2+$  red; hypothallus obscure; apothecia innate and adnate, round, often grouped and then angular; disk black, flat, then lightly convex, the margin at first prominent, then partly obscured; epithecium pale bluish or brown; thecium 60 to 80  $\mu$  high, colorless; paraphyses loosely coherent, not jointed nor forked, slightly capitate at the blue or brown apices; asci clavate, 54 to 76  $\mu$  high, 16 to 20  $\mu$  thick, the membrane thin, thickened above; hypothecium pale yellowish, in places almost colorless, with iodine permanently dark blue; spores in 8's, obovoid-ellipsoid and round-ellipsoid, the endospore and exospore distinct, 12 to 17  $\mu$  long, 6 to 9  $\mu$  thick, not affected by iodine.

Type locality near Avalon, Santa Catalina Island, on a sandstone boulder, and at the isthmus of the island on volcanic rock.

#### 18. *Lecidea enteroleuca* Ach.

Thallus mostly minutely verruculose, the small whitish or pale sulphur-colored wartlets also often flattish or squamulose, scattered or congregated or almost disappearing,  $\text{KHO}+$  yellow,  $\text{Ca}(\text{ClO})_2-$ ; (occasionally this last reagent giving a red color of the thallus); hypothallus indistinct; apothecia subinnate to sessile, small, 0.25 to 1 mm. wide, dispersed or grouped; disk black, dull or partly shining, flat, the proper margin concolorous, entire, the disk later convex and the margin obscure or excluded; epithecium continuous or subcontinuous, bluish black; thecium colorless; paraphyses lax-coherent; hypothecium pallid or dark; asci inflated to saccate; spores simple, ovoid or broadly ellipsoid, 9 to 18  $\mu$  long, 6 to 10  $\mu$  thick; spermatia acicular, arcuate.

On rocks; frequent and widely distributed. Varying as to thallus and hypothallus, causing the creation of forms, of which the following are found in our territory.



**18a. *Lecidea enteroleuca theioplaca* Tuck.**

Thallus of minute pale yellow verrucæ, mostly congregated, a black hypothallus distinctly seen, KHO+ yellow,  $\text{Ca}(\text{ClO})_2$ + light red; apothecia, etc., as in the species.

On slaty rock, Santa Monica Mountains.

**18b. *Lecidea enteroleuca aequata* (Floerke) Tuck.**

Thallus white or whitish ash-colored, irregularly and interruptedly rimose-areolate, KHO+ distinctly yellow,  $\text{Ca}(\text{ClO})_2$ —; epithecium bluish black, with KHO turning violet; hypothecium pale fuscous.

On calcareous rock, Santa Monica Mountains; on granite, Tehachapi Mountains at 1,700 meters altitude.

**18c. *Lecidea enteroleuca pilularis* (Davies?) T. Fries.**

Crust whitish and faintly ash-colored, verruculose and areolate-verruculose; apothecia adnate, small; disk flat with a thin, erect, black proper margin, later becoming convex and immarginate; epithecium subcontinuous, bluish; paraphyses loose; hypothecium pallid; asci clavate and inflated-clavate; spermatia arcuate.

Sandstone, Topanga Canyon, Santa Monica Mountains.

**19. *Lecidea goniophila* (Floerke) Schaer.**

Crust thin, granulose, ash-colored, often almost disappearing, KHO+ yellow,  $\text{Ca}(\text{ClO})_2$ + pale red; apothecia adnate, small, 0.25 to 0.75 mm. wide; disk black, primarily somewhat concave, the proper margin suburgid with a dark brown dash, finally planoconvex and the margin obsolete; epithecium pale bluish gray; thecium 100  $\mu$  high, colorless; paraphyses slender, loosely coherent; asci oblong about 12 to 16  $\mu$  shorter than the thecium; spores in 8's, oblong, ovoid-ellipsoid, one end often abruptly attenuate 16 to 20  $\mu$  long, 7 to 9  $\mu$  thick; spermatia "straight," not seen in our specimen.

On sandstone, Fatijo Ranch, Santa Cruz Mountains, *Herre*; northern base of the San Gabriel Range, at Shoemakers Ranch, Big Rock Creek, 1,500 meters altitude. England and continental Europe.

**20. *Lecidea euphorea* (Floerke) Nyl.**

Thallus pale greenish grayish, effuse, smooth, epiphloeodal, KHO+ yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, dispersed, small, 0.25 to 0.8 mm. wide, light colored internally, the disk brownish black, at first plane with a concolorous, prominent margin, this becoming obsolete and the disk planoconvex; epithecium colorless; thecium colorless; paraphyses free, not thickened at the apices; hypothecium colorless or with a faint yellowish tint; asci ventricose; spores in 8's, broadly ellipsoid, 11 to 16  $\mu$  long, 6 to 8  $\mu$  thick; hymenial gelatine with iodine blue, soon yellowish brown; spermatia acicular, arcuate. (Determined by Doctor Nylander.)

On *Umbellularia californica*, in canyons of the San Gabriel Range, Los Angeles County; on the same bark in the Santa Cruz Peninsula, *Herre*. Europe. Not heretofore reported from North America.

**21. *Lecidea tessellata* Floerke.**

Crust pale gray, areolate-rimose, the areolæ flat or somewhat concave, angular, determinate, a dark hypothalline border observable, KHO—; apothecia numerous, crowded, in places contiguous, imbedded in or slightly raised above the thallus, dark, dull black, flat; faintly pruinose, the margin thin, subpersistent; paraphyses subcoherent, with bluish black apices, these with KHO changing to brown; thecium sordid, colorless, about 56  $\mu$  high; hypothecium faintly colored; asci subventricose; spores in 8's, 9 to 11  $\mu$  long, 5 to 6  $\mu$  thick.

On granite, San Jacinto Mountains at 2,300 meters altitude; in the Santa Cruz Mountains at altitudes varying from 170 to 1,000 meters, *Herre*.



**22. *Lecidea glebulosa* (J. E. Smith) Schaer.**

Crust thick, of whitish, convex squamules, crenate-lobulate and rugulose, furfuraceous, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ +red (red reaction faint and tardy to appear in some specimens or altogether absent); apothecia sessile, often grouped and conglomerate; disk red brown, brown black, and dull black (as usually in the herbarium); disk at first flat, becoming convex and papillate, excluding the pale apothecial margin; epithecium continuous, reddish brown, gradually paling downward; thecium colorless, at least the lower part; paraphyses coherent, their tips clavate and slightly colored; hypothecium colorless; asci clavate or subinflated-clavate; spores oblong-ellipsoid, with blunt ends and one or several globules disappearing after KHO, 10 to 18  $\mu$  long, 4.5 to 7  $\mu$  thick; hymenial gelatine blue with iodine, no change by KHO.

On soft crumbling sandstone and earth in the Santa Monica Mountains; on earth at Point Loma near San Diego and at Eden Hot Springs, Riverside County; Santa Catalina Island.

**23. *Lecidea varians* Ach.**

Crust pale ash-colored, thin, granulose, circumscribed by a black hypothalline border, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia separate or congregated and then appearing conglomerate, adnate, dull brown, when moistened semitranslucent, soon becoming planoconvex and the margin obsolete; epithecium colorless or pale yellowish; hypothecium colorless or with barely a shade of color; paraphyses adglutinated; pores ovoid, 7 to 12  $\mu$  long, 5 to 7  $\mu$  thick; hymenial gelatine with iodine blue gradually; changing to brown.

Frequent on various living barks in the Santa Monica Mountains. Common throughout North America.

**4. *Lecidea querneae* (Dicks.) Ach.**

Crust granulate-pulverulent, yellowish greenish, thin, effuse; apothecia subinnate, numerous, dispersed; disk convex, brown black to black, the margin becoming obsolete; epithecium subcontinuous, brown; thecium about 80  $\mu$  high, colorless to light brownish; paraphyses coherent; hypothecium of the same color as the thecium; asci clavate; spores in 8's, 10 to 12  $\mu$  long, 7 to 8  $\mu$  thick; hymenial gelatine with iodine blue.

On various barks, Santa Monica Mountains; on redwood fence boards near "Pigeon Point Lighthouse," Santa Cruz Peninsula, *Herre*. West coast of North America, Europe.

**25. *Lecidea fuscescens* Sommerf.**

Thallus of minute, flat, grayish scales forming an effigurate crust upon a conspicuous, black hypothallus; apothecia numerous, small, 0.3 to 0.5 mm. in diameter, sessile; disk dull brown black or black, circular, flat with a thin inconspicuous margin, becoming finally obscure with the disk slightly convex; epithecium subcontinuous, bluish gray; thecium 48  $\mu$  high; paraphyses coherent; hypothecium colorless; asci cuneate, 42  $\mu$  long, 10  $\mu$  thick; spores in 8's, ovoid-ellipsoid, 6 to 10  $\mu$  long, 4 to 7  $\mu$  thick.

On living bark of *Grossularia hesperia*, in canyons of the Santa Monica Mountains.

Although assigned by the authorities cited to an alpine and subalpine habitat, it is here reported from this "subtropical" climate, corresponding well with the descriptions of Tuckerman and T. Fries.

**26. *Lecidea viridescens* (Schrad.) Ach.**

Thallus dull grayish green and darkening, its irregularly globular granules mostly approximate, effuse; hypothallus indistinct, KHO+yellowish brown,  $\text{Ca}(\text{ClO})_2$ +reddish; apothecia adnate or closely sessile, small; disk flat or slightly convex, black, soon immarginate; thecium 60  $\mu$  high, pallid; paraphyses brown at the apices



(some of them); hypothecium pale; asci inflated-clavate,  $48\ \mu$  long,  $12\ \mu$  thick; spores ovoid-ellipsoid,  $10\ \mu$  long, 3 to  $5\ \mu$  thick.

Frequent on bark of *Pseudotsuga macrocarpa* in the San Gabriel Range from middle to higher elevations, but rare in fruit. Northern United States and Canada; northern Europe.

**27. *Lecidea vernalis* (L.) Ach.**

Crust pale ash color, continuous (smooth and pale yellowish gray on bark of *Umbellularia californica*), and often granular; apothecia sessile, small, 0.25 to 0.3 mm. in diameter, dispersed or often crowded and contiguous; disk flat, dull rusty brown, the margin somewhat lighter in color, finally becoming dark reddish brown, slightly convex and the margin disappearing; epithecium colorless or pale smoky; thecium  $76$  to  $80\ \mu$  high; paraphyses adglutinated; hypothecium pallid, of similar hue to the epithecium; asci clavate; spores in 8's, ellipsoid, 8 to  $16\ \mu$  long, 3 to  $4\ \mu$  thick, not rarely appearing falsely bilocular; hymenial gelatine with iodine blue, turning a sordid greenish blue.

On various barks (*Juglans californica* *Salix lasiolepis*, *Ceanothus divaricatus*), in canyons of the Santa Monica Mountains and on decorticated pine in the San Gabriel Range at 1,700 meters altitude; on decorticated oak in the Tehachapi Range near "Lone Pine Mine." The forma *minor* Nyl. occurs on *Umbellularia californica* in the Santa Monica Mountains. Eastern and northern part of the United States; northern Europe.

**28. *Lecidea flexuosa* (Fries) Nyl.**

Crust of pale greenish gray, minute, flattish-convex squamules, many with a sorediose appearance, for the most part closely congregated, KHO—,  $\text{Ca}(\text{ClO})_2$ +red; apothecia sessile, the disk persistent flat, black, slightly roughened, the permanent margin thin, black, more or less flexuose; epithecium pale; thecium nearly colorless to sordid pale brown; paraphyses adglutinated, indistinct; hypothecium pale; asci clavate; spores obovoid-ellipsoid, 8 to  $10\ \mu$  long, 3 to  $5\ \mu$  thick; hymenial gelatine with iodine yellowish.

On charred manzanita wood, Santa Monica Mountains; Tehachapi Mountains on dead wood; bark of conifers in the San Bernardino Mountains. Eastern and southern United States; Europe.

**29. *Lecidea phaeophora* Stizenb.; Hasse, Bull. Torrey Club 24: 448. 1897.**

Crust pulverulent, indeterminate, nearly obsolete, KHO+orange,  $\text{Ca}(\text{ClO})_2$ —; apothecia crowded, sessile, the disk reddish brown (when moistened light flesh-colored), planoconvex, the margin indistinct, with a pulverulent, spurious thalline margin; epithecium pale, continuous; thecium colorless,  $52\ \mu$  high; paraphyses lax, coherent, the scarcely thickened apices of similar color to the epithecium; hypothecium colorless; asci clavate and inflated-clavate, about equaling the thecium in height; spores in 8's, oblong-ellipsoid, simple, colorless, 8 to  $12\ \mu$  long, 4 to  $7\ \mu$  thick; spermogones not seen; hymenial gelatine with iodine a handsome blue, including the epithecium and hypothecium, with KHO the epithecium a pale violet.

On calcareous rock near Avalon, Santa Catalina Island, the type locality.

Type deposited with Doctor Stizenberger in 1896, the fate of the specimen unknown to the writer; duplicate in herb. Hasse.

**30. *Lecidea myriocarpoides* Nyl.**

Crust dull brown, granulate-squamulose, or deficient; apothecia sessile, small 0.2 to 0.5 mm. in diameter; disk flat or slightly convex, undulate and blackening; margin permanent, thin, of a slightly lighter shade than the disk; epithecium dark brown; thecium dirty white, about  $48\ \mu$  high; paraphyses adglutinated; hypothecium pale brown; asci clavate; spores broadly ellipsoid, 8 to  $9\ \mu$  long, 4 to  $5\ \mu$  thick; hymenial gelatine with iodine blue, soon becoming brown.



On a dead stump of *Platanus racemosa* in the Santa Monica Mountains; on denuded oak wood in the Tehachapi Mountains, at 1,500 meters altitude. Eastern and southern United States and northern Europe.

**31. *Lecidea turgidula* Fries.**

Thallus thin, sordid white, effuse, of small globules forming a here and there obsolete crust; apothecia sessile, scattered or grouped and conglomerate; disk blackish brown, turgid, convex, soon immarginate; epithecium not granulose, grayish, darker than the hypothecium; thecium and hypothecium also gray; paraphyses adglutinated (thecium about  $40\ \mu$  high, with iodine blue); asci clavate; spores in 8's, ellipsoid, 10 to  $12\ \mu$  long, 3 to  $5\ \mu$  thick.

On bark of *Pseudotsuga*, Yosemite Valley.

**32. *Lecidea coarctata* (J. E. Smith) Nyl.**

Crust whitish to ash-colored, furfuraceous-squamulose, areolate or the squamules scattered, KHO—,  $\text{Ca}(\text{ClO})_2$ —, our lichen differing in this want of reactions from the European form according to the authors cited; apothecia small, dispersed, innate or adnate, the disk papillate, flat to planoconvex, reddish brown to blackening, occasionally with a pulverulent, spurious thalline margin; epithecium yellowish, granulose; thecium about  $120\ \mu$  high, colorless; asci inflated-clavate or oblong-cylindric; spores ovoid, 20 to  $23\ \mu$  long, 11 to  $12\ \mu$  thick.

Frequent on earth or rocks. Throughout the United States; in Africa; tropical America and Europe.

It differs somewhat in the thallus and of the resulting forms described by authors we have: Forma *elachista* (Ach.) T. Fries, the thallus consisting of thinly scattered areoles—on earth, Los Gatos, *Herre*; and forma *obtegens* T. Fries, with the thallus thick, spreading, granulate-pulverulent, the disk red brown—on earth, Santa Monica Range.

**33. *Lecidea granulosa phyllizans* Zahlbr. Beih. Bot. Centralbl. 13: 159. 1902.**

"Thallus in margine lobatus, lobis subcartilagineis, rotundatis, incisis vel inciscrenatis, in centro plicato-verruculosus, cinerascens-albidus, subpulverulentus, KHO lutescens,  $\text{Ca}(\text{ClO})_2$  bene erythrinosus, nunquam leproso-fatiscens. Apothecia primum plana, disco livido-vel ochraceo-fuscescente, demum nigricantia et immarginata. Conceptacula pycnoconidiorum copiosa, ubique in superficie thalli sita, punctiformia, globoso nigra, madefacta fuscescentia, semiimmersa; perithecio dimidiato; fulcris exobasidiis; basidiis anguste lageniformibus, dense congestis, subverticillatis vel verticillatis, pycnoconidiis bis vel ter longioribus; pycnoconidiis bacillariibus, medio hinc inde parum angustioribus vel uno apice leviter latioribus, rectis vel subrectis, apicibus obtusis, 7–9  $\mu$  longis et 1.2–1.5  $\mu$  latis.

"Ad terram inter muscos et *Cladonias* in declivibus occidentalibus montium San Gabriel, c. 1700 m. [Hasse no. 742]."

**34. *Lecidea xanthococcoides* Zahlbr. Bull. Torrey Club 27: 644. 1900.**

"Thallus tenuis, ruguloso-granulatus vel verrucosus, pallide cervino-fuscescens, KHO—,  $\text{Ca}(\text{ClO})_2$ —, non corticatus, hyphis non amyloideis. Gonidia protococcoidea, globosa, 10–18  $\mu$  diam. Apothecia parva (0.2–0.3 mm. lata), sessilis, nigra, opaca, primum modice concava vel plana, margine tenui, integro subnitidoque cincta, demum convexa et immarginata. Excipulum et hypothecium fuscum. Hypothecium obscure fuscum,  $\text{NO}_5$ —, KHO nubes fuscescentes effundens. Hymenium 160–180  $\mu$  altum. I coerulescens, dein obscure fulvescens. Paraphyses conglutinatae, tenues. Asci oblongo-vel ovoideo-cuneati, 8-spori. Sporae ovales vel oblongo-ovales, obtusae, simplices, hyalinae, 12–15  $\mu$  longae et 5.5–6  $\mu$  latae, episporio tenui.

"Habita ad *Lecideam xanthococcam* accedit, sed structura interna apotheciorum ab ea longe distat. *Lecidea hypomelaenae* Nyl. affinis.

"Ad truncos Coniferarum in montibus San Bernardino, circa 1,700 mt. s. m."



**35. *Lecidea subplebeia* Nyl. sp. nov. in litt.**

Crust dull white, pulverulent, rimose-areolate, effuse,  $\text{KHO—}$ ,  $\text{Ca}(\text{ClO})_2\text{—}$ , no reaction of the medulla with iodine; thallus now and then slightly rugulose; apothecia closely adnate, small, 0.25 to 0.5 mm. in diameter, dispersed; disk black, slightly convex in the fully developed apothecia; proper margin thin, black, persistent; thecium 48 to 60  $\mu$  high; paraphyses coherent, septate, with small, globular, dark heads; hypothecium pale fuscous, not horny; asci clavate; spores in 8's, ovoid-ellipsoid, 9 to 12  $\mu$  long, 6 to 7  $\mu$  thick.

On adobe soil and small pebbles, foothills of the Santa Monica Range. Type locality above "Brown's Lake," near the Soldiers' Home.

Type deposited with Dr. W. Nylander in 1897; duplicates with Dr. A. Zahlbruckner and in herb. Hasse.

**36. *Lecidea globifera* Ach.**

Thallus squamulose, fawn color or red to greenish red, paling at the edges and beneath, more or less closely imbricated, ascending to erect, not over 1 mm. wide, entire or round-lobed; apothecia sessile, the disk globose, purplish black, papillate, emarginate; epithecium yellowish brown; paraphyses adglutinate, not sharply defined; thecium sordid brown; hypothecium brown, paler than the epithecium; asci clavate; spores in 8's, ovoid-ellipsoid, 8 to 13  $\mu$  long, 5 to 7  $\mu$  thick.

On earth, frequent and widely distributed. San Bernardino, *Parish*; foothills of the Santa Monica and San Gabriel ranges; Palm Springs and the adjoining Colorado Desert.

The squamules of the desert forms are of darker brown color and the surface is fissured to rugulose.

**37. *Lecidea luridella* (Tuck.).**

*Biatora luridella* Tuck. Gen. Lich. 156. 1872.

Thallus of small squamules (0.5 to 2 mm. wide), round or sinuate-lobed, loosely imbricated, brown red, white pruinose at the circumference and pale beneath, forming roundish patches from 2.5 to 4 cm. wide,  $\text{KHO—}$ ,  $\text{Ca}(\text{ClO})_2\text{—}$ ; apothecia sessile, minute, central, mostly solitary, 0.5 to 0.8 mm. in diameter, the disk planoconvex, dark brown, the margin obsolete; epithecium granulose, pale ocher color; paraphyses coherent; thecium 60 to 68  $\mu$  high; hypothecium paler than epithecium or colorless; asci inflated-clavate; spores in 8's, ellipsoid and oblong-ellipsoid, 8 to 12  $\mu$  long, 4 to 6  $\mu$  thick; hymenial gelatine stained pale blue with iodine.

On earth; Castle Rock Park, Santa Cruz Peninsula, *Herre*; frequent on open grassy foothills of the Santa Monica Range near the Soldiers' Home; grassy plains at Muriette Hot Springs, Riverside County; Santa Catalina Island.

**38. *Lecidea friesii* Ach.**

Thallus scantily represented, of approximate, not contiguous, minute, dark dun-colored glebæ; apothecia appressed, minute, black, convex and slightly roughened, internally dark, the margin obscure; epithecium continuous, brown; thecium sordid pale brownish, 98  $\mu$  high; spores in 8's, ellipsoid, 8 to 9  $\mu$  long, 3.5 to 4  $\mu$  thick; hymenial gelatine with iodine pale sordid blue.

On carbonized bark in Mill Creek Canyon, San Bernardino Mountains at 1,500 meters altitude. Northeastern United States; northern Europe.

**39. *Lecidea decipiens* (Ehrh.) Ach.**

Thallus of discrete or crowded squamules, rotundate or lobulate, concave, peltately affixed, brick red to brown, whitened at the periphery (in exposed situations, as in the desert, often fissured), flat or ascendant, 2 to 4 mm. in diameter; apothecia sessile, marginal, 0.25 to 1 mm. wide; disk planoconvex, brown black, papillate, the margin soon excluded, the disk finally globose and not seldom conglomerate; epithecium yellowish brown; paraphyses adglutinate; thecium pale and yellowish; hypothecium



similar in color to the epithecium; asci clavate and inflated-clavate; spores in 8's, ovoid-ellipsoid, 11 to 16  $\mu$  long, 5 to 6  $\mu$  thick. "Spermatia minute, straight, affixed to subsimple sterigma" (Nyl.).

On earth, widely distributed throughout our territory; San Bernardino Mountains, *Parish*; near Palm Springs, where it is quite abundant. North America; northern Europe; northern Africa; Asia and Oceania.

#### 40 *Lecidea crenata* (Taylor) Nyl.

Thallus consisting of thick, roundish squamules, pink to flesh-colored and brownish, at the central point of adherence concave, depressed at the circumference, from 1 to 6 mm. wide, beneath white; apothecia sessile, extremely marginal, from one to several on a squamule, 0.25 to 0.5 mm. in diameter, the disk purplish black to black, the at first reddish brown margin soon excluded; epithecium yellowish brown; thecium colorless; paraphyses stout, adglutinate; hypothecium of the same color as or sometimes paler than the epithecium; asci inflated-clavate; spores in 8's, ellipsoid, 9 to 14  $\mu$  long, 4 to 5  $\mu$  thick; thecium with iodine blue, soon changing to brown.

With the last preceding species on earth in exposed situations and apparently as widely distributed. At the foot of Tauquitz Canyon, Palm Springs, *Dudley*, (communicated by Herre); Slover Mount, *Parish*; Elsinore.

The forma *dealbata* Tuck. is a state with whitened thallus. Occasionally with the species.

#### 41. *Lecidea rubiformis* Wahlenb.

Thallus of smooth, glistening, erect or suberect, closely imbricated squamules, large, 4 to 8 mm. wide, dun or pale fawn color, paler at the margin and beneath, wavy, entire, subcrenate or lobulate; apothecia central, sessile, purplish black to black, globular, immarginate, not seldom conglomerate; epithecium brown; paraphyses closely coherent; the entire thecium sordid light brown; hypothecium brown; asci clavate; spores in 8's, round-ellipsoid, 10 to 12  $\mu$  long, 6  $\mu$  thick; spermatia short, straight, 6 to 7  $\mu$  long and barely 1  $\mu$  thick.

On earth in crevices of rocks, Tehachapi Mountains at 1,650 meters altitude. Arctic North America; Colorado; Europe.

#### 42. *Lecidea rufonigra* (Tuck.)

*Biatora rufonigra* Tuck. Syn. N. Amer. Lich. 2: 11. 1888.

Thallus of small (0.25 to 0.75 mm. wide) squamules, these approximate, subimbricate, brown, convex or now and then flat and undulating, with finely crenulate and thick, gray, pulverulent and blackening margin, beneath dark; apothecia sessile, numerous, 0.25 to 1 mm. in diameter; disk dark brown to black with a grayish, crenulate margin to convex and immarginate; epithecium brown, continuous; thecium 40  $\mu$  high; paraphyses coherent, some with globular brown heads; hypothecium colorless; asci clavate; spores in 8's, 6 to 10  $\mu$  long, 4  $\mu$  thick; hymenial gelatine with iodine blue.

On quartz, Verdugo near Los Angeles; at Elsinore on sandstone. Throughout North America.

#### 43. *Lecidea scotopholis* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 80. 1910.

*Biatora scotopholis* Tuck. Lich. Calif. 24. 1866.

Thallus crustaceous-squamulose, dark brown black; hypothallus black; squamules mostly convex, more or less glistening, their finely crenulate border often whitish; potassium hydrate and calcium chloride giving no change; apothecia of medium size, closely sessile; disk flat, dull black with a paler, grayish margin, this at last obscured by the more convex disk; epithecium pale brown; thecium 40 to 44  $\mu$  high, staining blue with iodine; spores ovoid-ellipsoid, 8 to 11  $\mu$  long, 4 to 5  $\mu$  thick.

On quartzose rocks. Los Gatos, *Herre*; Yosemite Valley, Santa Catalina Island, and throughout the higher ranges of the southern California mountains.



**44. *Lecidea lurida* (Swartz) Ach.**

Thallus cespitose, of closely imbricate, in outline sinuate squamæ, bright cervine brown and shining above, whitish beneath, somewhat smaller than those of *L. globifera*; apothecia 1 to 1.5 mm. wide, sessile near center of squama, flat, becoming slightly convex, red brown with a brown proper exciple; epithecium red brown, gradually paling downward; thecium tinged more or less pale brownish, the lower part almost colorless, about  $90\ \mu$  high; paraphyses closely coherent; asci clavate; hypothecium obscurely brownish; spores ellipsoid and oblong-ellipsoid, colorless, 11 to  $16\ \mu$  long, 5 to  $6\ \mu$  thick; hymenial gelatine staining with iodine blue, soon changing to a sordid vinous color.

On earth. Santa Monica Mountains above Sherman.

**CATILLARIA Mass.**

Thallus crustaceous, uniform or lobulate at the periphery, ecorticate; algæ Protococcus; apothecia circular, innate to sessile, with a pallid or colored or even horny proper margin and hypothecium; paraphyses not branching, separate or coherent, at times capitate and colored at the tips; asci 8-spored; spores generally small, ovoid, ellipsoid to oblong, straight or curved, bilocular, the spore membrane and septa thin, without a halo; spermatia cylindric to oblong-ellipsoid, straight or curved.

**KEY TO SPECIES.**

Growing on bark.

Thallus gray.

Effuse, often indistinct; apothecia purplish black. . . . 6. *C. glauconigrans*.

Coarsely granular; apothecia black. . . . . 1. *C. atropurpurea*.

Thallus white or whitish.

Minutely squamulose. . . . . 2. *C. globulosa*.

Minutely granulose. . . . . 3. *C. tricolor*.

Growing on rock.

Thallus absent. . . . . 4a. *C. lenticularis*  
*acrustacea*.

Thallus present, more or less gray.

Thin.

Dull olive gray, smooth. . . . . 4. *C. lenticularis*.

Rimose-areolate. . . . . 5. *C. chalybeia*.

Not thin; squamulose, ash color. . . . . 7. *C. franciscana*.

**1. *Catillaria atropurpurea* (Schaer.) T. Fries.**

Crust thin, gray, coarsely granular, often poorly developed; apothecia small, sessile; disk flat, purplish black to black; hypothecium pale; asci clavate; spores ellipsoid to oblong-ellipsoid, distinctly bilocular, slightly constricted and one loculus smaller (narrower) than the other,  $15\ \mu$  long, 6 to  $7\ \mu$  thick.

On bark of Lombardy poplar near Ballona, Los Angeles County.

**2. *Catillaria globulosa* (Floerke) T. Fries.**

Thallus dingy white or grayish, granulate to minutely squamulose and obsolete, KHO—, Ca (ClO)<sub>2</sub>—; apothecia numerous, scattered or crowded, small, 0.25 to 0.3 mm. in diameter, adnate; disk dull brown to dull black with a thin dark grayish, subcrenulate margin, later becoming convex and papillate, the margin disappearing (moistened the disk and margin of the juvenile apothecia are seen a dull dun color); epithecium brownish black, gradually paling downward; thecium faint grayish or colorless,  $60\ \mu$  high; paraphyses adglutinate; hypothecium colorless; asci clavate; spores oblong or narrowly ellipsoid, some faintly bilocular, 9 to  $13\ \mu$  long, 4 to  $7\ \mu$  thick; hymenial gelatine with iodine intense blue.



On old fence boards near San Francisco, *Gray*; dead pine branchlets at Pacific Grove, *Herre*; on denuded pine wood, Tehachapi Mountains, at 1,650 meters altitude. New England States and Canada. Europe and northern Africa.

**3. *Catillaria tricolor* (With.) T. Fries.**

Thallus whitish to ash gray, minutely granulose, KHO+yellow, Ca(ClO)<sub>2</sub>—; apothecia minute, sessile, the disk brownish, flat and with a thin, paler, pulverulent margin, later becoming darker, the margin disappearing; epithecium subgranulose, pale brownish; thecium 56  $\mu$  high, colorless; paraphyses subcoherent, capitate at the brownish tips; hypothecium colorless; asci clavate; spores bilocular, oblong, 9 to 12  $\mu$  long, 3.5 to 4  $\mu$  thick, some slightly curved, others apparently simple.

On various barks. Tuckerman distinguishes a variety *atlantica* "with spores scarcely other than simple," from variety *pacifica*, with typical spores and a decussating black hypothallus. Santa Cruz Mountains, the variety *pacifica*, *Herre*, and Alameda County, *Gray*. In the Santa Monica Mountains both varieties occur on the same piece of bark.

**4. *Catillaria lenticularis* (Ach.) T. Fries.**

Crust sordid olive greenish gray, finely and obscurely rimose-areolate, minutely granulose, effigurate, KHO—; apothecia small, from 0.25 to 0.5 mm. in diameter, dispersed, the disk brown black to black, flat with a regular, elevated margin, later convex and immarginate; epithecium subcontinuous, brown to dark brown; thecium 56 to 60  $\mu$  high; colorless; paraphyses loosely coherent with globular, dark brown black heads; hypothecium pallid or pale brownish; asci clavate; spores faintly bilocular, narrowly ellipsoid, 8 to 12.5  $\mu$  long, 2 to 3  $\mu$  thick, the membrane thin; hymenial gelatine with iodine blue, excepting the epithecium and hypothecium, these not affected by the reagent.

This is the forma *vulgaris* of authors. On slate rock in the Santa Monica Range.

**4a. *Catillaria lenticularis* forma *acrustacea* Hepp.**

Thallus absent; apothecia numerous, crowded, attaining a somewhat greater diameter than the species, the disk black, flat to lightly convex, the margin subpersistent; epithecium dark brown, paling downward; thecium about 80  $\mu$  high; paraphyses loosely coherent, grayish or brownish gray, capitate; asci narrowly clavate; hypothecium nearly or entirely colorless; spores bilocular, narrowly ellipsoid, 14 to 15  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine blue.

Sandstone boulder on Santa Catalina Island.

**5. *Catillaria chalybeia* (Borr.).**

*Lecidea chalybeia* Borr.; Leight. Lichenfl. Brit. ed. 3. 326. 1879.

Crust thin, smooth, ashy gray, finely rimose-areolate, KHO—, Ca(ClO)<sub>2</sub>—; apothecia sessile, dispersed, small, 0.3 to 0.5 mm. in diameter, the disk flat to slightly convex, black; margin persistent, regular and entire; epithecium brown; paraphyses quite separate with abruptly capitate, brown heads; thecium 52 to 60  $\mu$  high; hypothecium brown; asci inflated-clavate, about 42  $\mu$  long, 12  $\mu$  thick; spores fusiform-ellipsoid and narrowly ellipsoid, bilocular, acuminate at the ends, 10 to 12  $\mu$  long, 3 to 4  $\mu$  thick; hymenial gelatine with iodine light blue.

On trap, north fork of Matilija Canyon, Ventura County.

**6. *Catillaria glauconigrans* (Tuck.).**

*Biatorea glauconigrans* Tuck. Proc. Amer. Acad. 12: 179. 1877.

Thallus thin, ash gray, effuse and indistinct; apothecia minute to small, adnate, the disk black, flat to planoconvex, the margin concolorous and persistent, regular, entire; epithecium granulose, black brown; thecium colorless, 60 to 64  $\mu$  high; paraphyses free, some of them globular-thickened and dark at the apices; hypothecium brown, of lighter shade than the epithecium; asci clavate, 40 to 44  $\mu$  long, 7 to 8  $\mu$  thick; spores bilocular, ellipsoid, 6 to 11  $\mu$  long, 2 to 3  $\mu$  thick.

On bark of *Rhus diversiloba*, canyons of Santa Monica Range.



7. *Catillaria franciscana* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 95. 1910.

*Biatora franciscana* Tuck. Syn. N. Amer. Lich. 2: 32. 1888.

Thallus of whitish to gray, scattered or crowded squamules; apothecia small to middling size, 0.5 to 0.8 mm. in diameter, the disk from flat to convex, and the at first somewhat paler proper margin disappearing, the blackish disk often with a bloom; epithecium dark violaceous black; paraphyses separate, gray, capitate; thecium 60 to 64  $\mu$  high; hypothecium colorless or sordid; asci cylindric-clavate, 40  $\mu$  long, 10 to 12  $\mu$  thick; spores bilocular, oblong, 12 to 22  $\mu$  long, 3.5 to 5  $\mu$  thick; hymenial gelatine with iodine blue, soon changing to claret brown.

On argillaceous and other rocks in the Santa Monica Range; at Newport; bluffs at White Point, near San Pedro.

**BACIDIA** De Not.

Thallus crustaceous, uniform, ecorticate, with Protococcus gonidia; apothecia circular, sessile for the greater part; disk flat or convex, the proper margin and hypothecium pale or dark; paraphyses not branched, loose or coherent, often with capitate apices; asci 8 to 16-spored; spores colorless, parallel 3-locular to plurilocular, fusiform to acicular, both ends alike or one caudate-acuminate, straight, curved, or spirally interwoven, with cylindric loculi, the septa thin, often indistinct, without a gelatinous halo; spermatia short-cylindric to acicular, straight or curved.

KEY TO SPECIES.

Substratum mineral.

Growing on earth..... 1. *B. gyalectiformis*.

Growing on rock.

Thallus dark..... 10. *B. umbrina*.

Thallus light colored..... 11. *B. kingmani*.

Substratum vegetable.

Growing on wood; thallus light colored..... 2. *B. milliaria*.

Growing on bark.

Spores 3 or 4-locular.

Thallus staining yellow with KHO..... 4. *B. jacobi*.

Thallus not staining with KHO..... 3. *B. naegelii*.

Spores more than 4-locular.

Spores 10 to 17-locular.

Apothecia brown to dark brown..... 5. *B. fusciorubella*.

Apothecia black..... 7. *B. clementis*.

Spores plurilocular, acicular, one end attenuate.

Apothecia light pink to flesh-colored..... 9. *B. albescens*.

Apothecia more or less black.

Brown black..... 8. *B. endoleuca*.

Fawn color to black purple..... 6. *B. rubella*.

1. *Bacidia gyalectiformis* (Zahlbr.).

*Bilimbia gyalectiformis* Zahlbr. Beih. Bot. Centralbl. 13: 158. 1902.

Thallus dingy white, pulverulent, rugulose, effuse, irregularly rimose, KHO—, Ca(ClO)<sub>2</sub>—; apothecia dispersed, immersed, gyalectiform, surrounded by a subcoarctate spurious thalline margin; disk flat, reddish to blackish brown; epithecium continuous, pale yellowish brownish; thecium colorless, 100 to 128  $\mu$  high; paraphyses slender, subcoherent, not thickened at the apices; hypothecium colorless to yellowish; asci about 104  $\mu$  long, 20  $\mu$  thick; spores 8 in asci, ellipsoid to oblong-ellipsoid, straight, 4-locular, 20 to 28  $\mu$  long, 6 to 7  $\mu$  thick; hymenial gelatine pale blue with iodine.



On sandy earth and at eastern base of San Jacinto Mountains, near Palm Springs, at 170 meters alt.

Type specimen deposited with Dr. A. Zahlbruckner; duplicates in the U. S. National Herbarium and in herb. Hasse.

**2. *Bacidia milliaria* (Fries) Koerb.**

Only the forma *ligniaria*, with the following characters, is represented in our flora.

Crust thin, effuse, granular, and minutely squamulose, the squamules dispersed or congregated and obscurely rimose, KHO—, Ca(ClO)<sub>2</sub>—; apothecia small, 0.5 to 0.75 mm. in diameter, sessile, purplish black; disk flattened, opaque, the margin thin, entire, elevated, later convex and subglobular, then black and the margin disappearing; epithecium reddish brown or violaceous, gradually paling downward; paraphyses loosely coherent or some with vinous red small heads; thecium about 60  $\mu$  high, colorless, at least the lower part; hypothecium pallid to pale yellowish; asci clavate, 48 to 52  $\mu$  high, 8 to 12  $\mu$  thick, equaling the thecium in height; spores acicular or thin fusiform, 28 to 32  $\mu$  long, 3.5 to 4  $\mu$  thick, 4 to 7-locular.

On dead, decorticated wood, Tehachapi Mountains, at 1,700 meters altitude. Eastern United States and Europe.

**3. *Bacidia naegelii* (Hepp) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 135. 1907.**

*Biatora naegelii* Hepp, Spor. Flecht. Eur. pl. 4. f. 1, 19. 1853.

Thallus whitish to sordid olive green, coarsely granular, effuse, thin; apothecia small, 0.75 to 0.8 mm. in diameter, scattered or crowded to confluent; disk dull brown, gradually darkening to black, apparently convex from the first, the lighter colored, dark gray proper margin not prominent and at last obsolete; epithecium partly colorless, partly bluish blackish; paraphyses coherent, their clavate apices bluish blackish; hypothecium colorless; asci inflated-clavate; spores fusiform, ellipsoid, straight or lightly curved, mostly 4-locular, 16 to 24  $\mu$  long, 3.5 to 5  $\mu$  thick; hymenial gelatine blue with iodine.

On various living and dead barks, Washington, *Foster*; Santa Cruz Peninsula, *Herre*; in canyons of the Santa Monica Mountains. Eastern United States. Europe.

**4. *Bacidia jacobii* (Tuck.).**

*Biatora jacobii* Tuck. Syn. N. Amer. Lich. 2: 48. 1888.

Thallus white to light ash gray, minutely scurfy or pulverulent, effuse, forming small white patches, KHO+ yellow, Ca(ClO)<sub>2</sub>—; hypothallus apparently pallid; apothecia appressed, small, 0.25 to 0.3 mm. in diameter, one or several on a thalline patch; disk flat to planoconvex, black with a thin, entire, persistent, concolorous margin, but this finally obscured; epithecium granulose, fuliginous brown; thecium 48 to 56  $\mu$  high; paraphyses subcoherent, indistinct with abruptly thickened, black heads; hypothecium of the same dark color with the epithecium; asci clavate to inflated-clavate, nearly equaling the thecium in height, 36 to 48  $\mu$  long, 14 to 16  $\mu$  thick; spores fusiform, one end long-attenuate, the other short-acuminate, 4-locular, slightly curved, 20 to 26  $\mu$  long, 2 to 3  $\mu$  thick; hymenial gelatine with iodine light blue, the tops of asci darker and changing to violet; spermogones not found.

On bark of *Malvastrum fasciculatum*, in canyons of the Santa Monica Range. Type locality, "San Diego," collected by Doctor Palmer on trees.

**5. *Bacidia fuscorubella* (Hoffm.) Arnold.**

Thallus crust whitish to cinerascens, granulate-roughened and obsoletely rimose, effuse; apothecia sessile, 0.25 to 0.6 mm. in diameter; disk brown black to black and flat with a thin, concolorous margin to convex, papillate, and immarginate; epithecium brown; thecium of same color with the hypothecium, dingy yellowish gray, and scarcely higher than the asci; asci clavate, 80  $\mu$  long, 12  $\mu$  thick; spores blunt at each end, 40 to 76  $\mu$  long, 4  $\mu$  thick, 14 or 15-locular.

On various barks in the Santa Monica Range.



**6. *Bacidia rubella* (Hoffm.) Mass.**

Crust pale gray to pale greenish ash color, thin, effuse, granulose; apothecia sessile, small, 0.25 to 1 mm. in diameter; disk flat, finally convex and from fawn color to blackish purple, the margin at first delicately pruinose (which is forma *porriginosa* (Turn.) Arn.), later naked, (forma *luteola* (Schrader.) T. Fries); epithecium continuous, colorless, 72 to 80  $\mu$  high; paraphyses coherent, slightly thickened above but colorless; hypothecium colorless; asci clavate, 68  $\mu$  long, 12  $\mu$  thick; spores acicular, one end finely attenuate, 48 to 68  $\mu$  long, 2 to 3  $\mu$  thick, indistinctly plurilocular, straight or slightly curved; thecium, epithecium, and hypothecium blue with iodine; thallus KHO—.

On living barks, Santa Monica Range. North America and Europe.

**7. *Bacidia clementis* Hasse, Bryologist 13: 61. 1910.**

Thallus crust moderately thick, whitish, coarsely granular and rugulose, becoming chinky, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, small, 0.2 to 0.8 mm. in width; disk flat, brown black, the proper margin entire, concolorous, soon becoming convex, black and the margin obsolete; epithecium colorless, granulose; thecium colorless to pale brown at the periphery; paraphyses not coherent, not thickened nor colored at the apices; asci clavate to subcylindric; 68 to 112  $\mu$  high, 12 to 16  $\mu$  thick, the membrane not at all or slightly thickened at the top in the larger sacks; spores cylindric, 60 to 80  $\mu$  long, 4 to 5  $\mu$  thick, both ends equally bluntly rounded without attenuation, once or twice gently curved, 15 to 17-locular; hymenial gelatine giving no reaction with iodine, only the asci becoming yellow, the juvenile, immature ones darker, the escaped spores not staining with iodine; hypothecium yellowish gray to brown; spermogones minute black protrusions on the thallus; sterigma straight, simple; spermatia acicular, straight or slightly curved, 10 to 12  $\mu$  long.

On bark of *Heteromeles arbutifolia*, San Clemente Island, Trask in 1893. In 1903 collected on the same bark in the Santa Ynez Canyon of the Santa Monica Range. Type deposited in herb. Hasse.

This species is near *Bacidia fuscorubella*, with which it was at first confounded, but differs in the length of its spores and in its chemical reactions.

**8. *Bacidia endoleuca* (Nyl.) Kickx.**

Crust thin, granulate, effuse, greenish gray; apothecia sessile, scattered, 0.25 to 1 mm. wide; disk brown black to black, marginate, flat to convex, the margin not quite disappearing; epithecium subcontinuous, umber brown and gray, gradually paling downward; thecium colorless, 52 to 80  $\mu$  high; paraphyses loosely coherent, clavate at the tips; hypothecium pale yellowish; asci clavate; spores acicular, slightly thicker at upper end, gradually attenuate at the other, multiseptate, 28 to 60  $\mu$  long, 1 to 4.5  $\mu$  thick; hymenial gelatine with iodine blue, turning dingy brown; epithecium and hypothecium not stained by iodine.

On various barks; "Mission Ridge" at Santa Barbara, Herre; canyons of San Gabriel Range, Los Angeles County. Southern North America to South America; Europe; Japan.

**9. *Bacidia albescens* (Arnold) Zwackh.**

Crust thin, effuse, silver gray to ash color, pulverulent and granular; apothecia minute to small, up to 0.6 mm. wide, sessile, scattered; disk flattish, marginate to more convex and immarginate, from light pink to flesh color; epithecium subcontinuous, light yellowish brown paling downward, becoming light grayish brown at the periphery; thecium 60  $\mu$  high, colorless; paraphyses coherent, clavate at apices; hypothecium colorless; asci clavate, 48 to 52  $\mu$  long, 8 to 10  $\mu$  thick; spores acicular, slender, one end slightly thickened, the other attenuate, 28 to 44  $\mu$  long, 2  $\mu$  thick pluriseptate; hymenial gelatine blue with iodine, including the epithecium and hypothecium.



On various living barks, Santa Monica Range. New England States; tropical America, Cuba; Europe; Japan.

**10. *Bacidia umbrina* (Ach.) Branth & Rostr.**

Crust pale ash to sordid blackish olive green color, of coarse, flattened and irregular-shaped granules, when dry accumulated into warty, obscurely rimose elevations, when moistened the crust dark black green and the granules contiguous; apothecia subinnate to adnate, 0.25 to 1 mm. wide; disk black, plane with a thin, concolorous margin, later the disk becoming almost semiglobular, the margin vanishing; epithecium blackish brown; thecium 60  $\mu$  high; almost colorless; paraphyses intricately interwoven; hypothecium similar in color to the epithecium; asci inflated-clavate, the membrane thick; spores acicular, bowed and doubly arcuate, the ends blunt, one rounded, 16 to 28  $\mu$  long, 3.5 to 5  $\mu$  thick, mostly 4-locular, intertwined in the spore sack and thus giving the appearance of a multisporeous ascus.

On sandstone, Ballona Bluffs near Santa Monica; at Santa Barbara. Eastern United States; Europe.

Our plant is the forma *psotina* (Fries) T. Fries with the heads of the paraphyses sordid olivaceous brown.

**11. *Bacidia kingmani* Hasse, Bryologist 14: 101. 1911.**

Thallus poorly represented by small congregated or scattered, sordid light olive green, imbricated squamules, or evanescent; squamules about 0.5 mm. wide, flat or conchiform; hypothallus indistinct; apothecia sessile or substipitate, 2 to 3.5 mm. wide; disk dull black, flat to convex, often with a faint grayish bloom, the persistent proper margin turgid, gray pruinose, generally strongly crenate-sinuose; epithecium subcontinuous, bluish black; thecium colorless, 88  $\mu$  high; paraphyses coarse, scarcely thickened above, with light brown tips; hypothecium dark brown, thicker than the thecium; asci narrowly clavate, not reaching the epithecium, 8 to 10  $\mu$  thick, often slightly curved, the septa indistinct; hymenial gelatine staining dark blue with iodine.

On quartzose rock in the San Gabriel Range along the "New Trail" to Mount Wilson. Collected by Mr. C. C. Kingman.

Type in the herbarium of the collector; duplicate in the author's herbarium.

**TONINIA Mass.**

Thallus crustaceous-squamulose, rugose to caudate, lobate at the periphery; gonidia Pleurococcus; apothecia circular, sessile, biatorine or lecideine, without a lecanorine margin; paraphyses simple, discrete or coherent, thickened and often capitate at the tips; hypothecium pallid or dark; ascus membranes thin; spores in 8's, elongated-ellipsoid to almost staff-shaped, parallel-bilocular to parallel-plurilocular, the loculi cylindric, the wall thin, without a halo; spermatogones immersed, spermatia capillary or acicular, curved, rarely straightened.

**KEY TO SPECIES.**

Growing on earth.

Thallus bullate, gray to brown gray..... 1. *T. coeruleonigricans*.

Thallus not bullate.

Squamulose, pale gray..... 2. *T. cumulata*.

Verruculose, of small gray warts..... 6. *T. massata*.

Growing on rock; thallus squamulose.

Squamules cervine brown, thick.

Spores 5-locular..... 3. *T. squarrosa*.

Spores more than 5-locular..... 3a. *T. squarrosa persimilans*.

Squamules not cervine brown.

Blackish..... 4. *T. ruginosa*.

Gray with a shade of green..... 5. *T. aromatica*.



**1. *Toninia coeruleonigricans* (Lightf.) T. Fries.**

Thallus of bullous, semiglobular squamæ, discrete or crowded, dull brown or dingy greenish gray, naked or pruinose, the larger sublobate; apothecia substipitate between the squamæ, of middling size to large; disk black, flat-convex, the margin indistinct and with the later increasing convexity of the disk almost disappearing; paraphyses loose, the tips fuliginous, capitate; asci clavate; spores bilocular, fusiform, 14 to 26  $\mu$  long, 2 to 4  $\mu$  thick; hymenial gelatine with iodine blue changing to reddish.

On earth "in mountainous and high northern regions" (Tuckerman), but we have it in southern California and, as at Palm Springs, at only 170 meters above sea level; at the north fork of the Matilija Canyon, in Ventura County. Rocky Mountain States; Europe; northern Asia and northern Africa.

**2. *Toninia cumulata* (Sommerf.) T. Fries.**

Thallus of small, white or pale gray squamules, these irregularly shaped, scattered or contiguous, KHO—,  $\text{Ca}(\text{ClO})_2$ —, the medullary hyphæ giving no reaction with iodine; apothecia small and mostly congregated into prominent heaps; disk in the isolated apothecia round, flat, black, with a raised, thick, black, entire or crenulate margin, the disk later becoming slightly convex, the margin thinner to almost disappearing; epithecium subgranulose, dark brown; thecium dark, 72  $\mu$  high; paraphyses coherent, the brown heads clavate; hypothecium yellowish or reddish brown, not as dark as the epithecium; asci clavate and subinflated-clavate, 62  $\mu$  long, 12  $\mu$  thick; spores 4-locular, fusiform-ellipsoid, 14 to 18  $\mu$  long, 4.5 to 6  $\mu$  thick, the ends slightly acuminate, one more so than the other; hymenial gelatine blue with iodine.

On sandy clay bluffs near Newport, Orange County. Subalpine northern Europe and arctic regions of North America.

**3. *Toninia squarrosa* (Ach.) T. Fries.**

Thallus cervine brown, squamulose, thick, the squamules congregated, subimbricate, lobulate, rugose and convolute, KHO—; apothecia sessile, medium-sized to large and conglomerate; disk black, at first flat, margined, passing to strongly convex, lobulate and immarginate; epithecium subcontinuous, bluish blackish; thecium colorless, 60 to 64  $\mu$  high, with iodine blue, but the epithecium and hypothecium not affected; paraphyses coherent, strict, their apices clavate and bluish black; hypothecium sordid pale yellowish; asci subinflated-clavate; spores straight or lightly curved, acicular-fusiform, one end thicker and blunt, the other attenuate, about 4-septate, the septation faint, 23 to 40  $\mu$  long, 2 to 3.5  $\mu$  thick.

Forming cushions among moss on rocks; mountains of northeastern California, Herre; Yosemite Valley; Strawberry Valley, San Jacinto Mountains, at 1,600 meters altitude. Alpine and arctic regions of western North America; northern Asia; Europe.

**3a. *Toninia squarrosa persimilans* Hasse, subsp. nov.**

*Lecidea squarrosa persimilans* Nyl. in litt.

Varies from the species in the spores, which are 37 to 68  $\mu$  long and 4  $\mu$  thick, and from 4-locular to plurilocular, narrowly fusiform, one end gradually attenuate, the other abruptly acuminate or blunt in some spores.

On earth in the San Gabriel Range, Los Angeles County, on the "Old Wilson Trail" at 830 meters altitude (the type locality).

Type deposited with Prof. Bruce Fink; duplicates in U. S. National Herbarium and in herb. Hasse.

**4. *Toninia ruginosa* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 103. 1910.**

*Lecidea ruginosa* Tuck. Lich. Calif. 25. 1866.

Thallus of rounded, turgid, bullose squamules, more or less crowded, wavy and rugose-plicate, finally cancellate, from blackish green to brown; "apothecia ample to large, 1.5 to 3 mm. in width, flat, at length flexuose-lobate, scarcely excluding the stout margin;" epithecium subgranulose, brown; thecium colorless to light brown,



56 to 60  $\mu$  high; paraphyses laxly coherent, with brownish clavate tips or colorless in the same apothecium; hypothecium sordid yellowish to yellowish brown; spores acicular-fusiform, attenuate-caudate at one end, at the other blunt, 25 to 30  $\mu$  long, 3 to 4  $\mu$  thick, faintly pluriseptate; hymenial gelatine blue with iodine, KHO staining the epithecium a violet purple; no change with  $\text{NO}_2$ .

On rocks, north fork of Matilija Canyon, Ventura County. Coast of California.

**5. *Toninia aromatica* (J. E. Smith) Mass.**

Thallus of rugulose, contorted, greenish gray or sordid pale olive green squamules, these congested and subimbricated, with a crenulate-lobulate border; apothecia sessile, now and then conglomerate or clustered; disk black, round with an entire margin to convex with the margin obsolete; epithecium subcontinuous, dark brown; thecium 40 to 60  $\mu$  high, colorless to slightly yellowish tinted; paraphyses strict, loosely coherent, entire, simple, some clavate and with grayish violet tips; hypothecium dark yellowish brown, nearly as high as the thecium; asci clavate; spores dactyliform-cylindric or narrow fusiform, both ends obtuse, 4-locular, 10 to 26  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine blue, changing to reddish brown, KHO staining the epithecium violet.

On sandrock near Mayfield, *Herre*; Santa Catalina Island; Santa Monica Range; at Murietta Hot Springs, Riverside County. Europe; Africa.

**6. *Toninia massata* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 103. 1910.**

*Lecidea massata* Tuck. Lich. Calif. 25. 1866.

Thallus of loosely aggregate, gray verrucæ the size of a poppy seed or less, forming a rimose crust, KHO+ pale yellow,  $\text{Ca}(\text{ClO})_2$ —; hypothallus indistinct; apothecia numerous, interspersed among the thalline verrucæ and barely as large as these, innate-sessile; disk black, smooth and soon convex and immarginate; epithecium granulose, brown; thecium sordid yellow, with iodine blue, soon changing to red brown; paraphyses adglutinate and indistinct; hypothecium thick, dark brown, as thick as or thicker than the thecium; asci subinflated-clavate, 36  $\mu$  long, 16  $\mu$  thick; spores bilocular, 12 to 15  $\mu$  long, 4 to 5  $\mu$  thick; thecium about 40  $\mu$  high; hymenial gelatine stained blue with iodine, soon changing to red brown.

On earth, Santa Monica Mountains; Verdugo Mountains near Los Angeles; at Point Loma near San Diego.

**RHIZOCARPON Ramond.**

Thallus crustaceous, uniform; apothecia lecideine, circular, sessile or innate upon or between the thalline squamules, with a black carbonaceous margin and a dark hypothecium; hymenium gelatinous; paraphyses branching, lax and interwoven; asci containing 1 to 8 spores; spores colorless or brown or dark from the first, parallel-bilocular to more locular or muriform, with a gelatinous halo; spermatia cylindric to acicular, straight or nearly so.

**KEY TO SPECIES.**

- |   |                             |
|---|-----------------------------|
| Growing on earth; spores not colored.....           | 6. <i>R. athalloides</i> .  |
| Growing on rock.                                    |                             |
| Spores not colored.....                             | 5. <i>R. distinctum</i> .   |
| Spores dark.  |                             |
| Thallus some shade of yellow.                       |                             |
| Bright yellow, areolate.....                        | 1. <i>R. geographicum</i> . |
| Dull greenish yellow, consisting of small verrucæ.. | 2. <i>R. viridiatrum</i> .  |
| Thallus not yellow.                                 |                             |
| Thallus brown.....                                  | 7. <i>R. bolanderi</i> .    |
| Not brown.  |                             |
| Gray, spores 2.....                                 | 3. <i>R. geminatum</i> .    |
| Whitish, spores 4 to 8.....                         | 4. <i>R. petraeum</i> .     |



**1. *Rhizocarpon geographicum* (L.) Lam. & DC.**

Thallus yellow and greenish yellow, areolate, the areoles flat, contiguous (forma *contigua* Fries) or dispersed, with a distinct hypothallus; apothecia small, scarcely exceeding 0.5 mm. in width, impressed, the disk black, mostly angular, the margin black, thin; apothecia numerous, often crowded, interspersed among the areoles (the typical form) or encircled by an areole (forma *lecanorina* Floerke); epithecium continuous, light yellowish brown; thecium about  $160\ \mu$  high, colorless or of a pale yellowish brown tint; paraphyses stout, 2 to  $4\ \mu$  thick, their outlines not clean cut, containing many guttulæ; hypothecium dark brown, gradually paling upward; asci ventricose; spores variously shaped, short-ellipsoid or oblong, 4-locular but mainly muriform, dark brown, the loculi with a bluish black tint, mostly with 3 main septa and additional secondary, thinner partitions, 30 to  $40\ \mu$  long, 14 to  $20\ \mu$  thick; hymenial gelatine blue with iodine.

On hard crystalline rocks. Santa Cruz Mountains at 928 meters altitude, *Herre*; in the mountains of southern California at about 1,000 meters and ascending thence. From the central part of North America to arctic regions; Europe. The forms occur together and with the type.

**2. *Rhizocarpon viridiatrum* (Floerke) Koerb.**

Thallus greenish yellow, areolate, the areoles distinctly verruculose, pulverulent; hypothallus black; apothecia arising from the black hypothallus, subsessile, protruding above the level of the thallus and somewhat larger than in the preceding species, the disk dull black, flat to convex, papillate or roughened, the margin somewhat brown black, crenulate, long-persistent; spores as in *R. geographicum*.

On trap rock, Topanga Canyon, Santa Monica Range. Europe.

The thallus does not spread so wide as in *R. geographicum* and appears dusky from fine capillary lines extending over the areoles.

**3. *Rhizocarpon geminatum* (Flot.) Koerb.**

Crust verrucose-areolate, dark ash gray with a faint shade of red or brown, scattered or approximate; hypothallus not very distinct; apothecia sessile; disk flat, black, the margin slightly elevated, entire, and persistent; epithecium granulose, violaceous black; thecium pallid; paraphyses coherent; hypothecium black brown; asci ventricose; spores one or two in the asci, 28 to  $36\ \mu$  long, 16 to  $20\ \mu$  thick, dark brown; hymenial gelatine staining an intense blue with iodine, especially the epithecium, this becoming almost black; no change with  $\text{NO}_5$ .

On rocks. Santa Cruz Mountains, *Herre*; San Bernardino Mountains near "Seven Oaks" at 2,000 meters altitude.

**4. *Rhizocarpon petraeum* (Wulf.) Koerb.**

Thallus as in the preceding, not stained by KHO; spores 6 to 8 in the asci, oblong, brown, 4 to 5-locular and submuriform with a thick halo, 22 to  $32\ \mu$  long, 10 to  $16\ \mu$  thick; hymenial gelatine with iodine blue; no change with KHO or  $\text{NO}_5$ .

With the preceding. Throughout the greater part of North America; Europe.

**5. *Rhizocarpon distinctum* T. Fries.**

Thallus whitish to leaden gray, interruptedly rimose-areolate, the areoles small, flattish or concave, KHO—,  $\text{Ca}(\text{ClO})_2$ —; hypothallus black; apothecia adnate, small, 0.5 to 0.75 mm. wide, the disk dull black, flat, papillate, with a thin, yellowish gray, at first slightly elevated margin, later obsolete as the disk becomes convex; epithecium brown black, gradually paling downward, with KHO pale violaceous; thecium pallid, with iodine blue; paraphyses coarse; spores muriform, colorless, oblong-ellipsoid, 24 to  $36\ \mu$  long; 12 to  $16\ \mu$  thick.

On argillaceous sandstone and shale, near Pescadero and near New Almaden, *Herre*; may extend to southern California.



**6. *Rhizocarpon athalloides* (Nyl.)**

*Lecidea athalloides* Nyl. Bull. Soc. Bot. France 7: 503. 1860.

Crust gelatinous when moist, indeterminate, sordid whitish ochraceous, indistinctly rimose or granulate, of a loose web of hyphæ, KHO—, Ca(ClO)<sub>2</sub>—; apothecia innate, 0.5 to 1.5 mm. wide, primarily covered by a thallus that finally ruptures, leaving a coarctate, lacerated rim surrounding the dull black, flat or gently convex disk, when moist with a shade of brown, round or irregularly oblong with an indistinct, entire or crenulate and wavy proper margin; epithecium pale sordid yellowish, subgranulose; thecium 120 to 124  $\mu$  high, colorless or nearly so; paraphyses slender, adglutinated, gelatinous; hypothecium slightly darker than the epithecium, darkening to yellowish brown; asci subventricose, shorter than the thecium, ill-defined; spores 4 or 5 in the asci, ovoid, 4 to 5-locular and submuriform, 32 to 40  $\mu$  long, 14 to 20  $\mu$  thick; no reaction of the thecial structures with KHO or Ca(ClO)<sub>2</sub>; hymenial gelatine with iodine a pale vinous red, with NO<sub>5</sub> no change except a darkening of epithecium and hypothecium.

On earth; foothills of Santa Monica Range and Verdugo Mountains near Los Angeles. Europe on the Island of Corsica.

**7. *Rhizocarpon bolanderi* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 106. 1910.**

*Buellia bolanderi* Tuck. Gen. Lich. 189. 1872.

Crust dark chestnut, of small, round or wavy squamules, separate or approximate, upon a conspicuous black hypothallus, giving the crust an almost black appearance. KHO—, Ca(ClO)<sub>2</sub>—, medullary hyphæ with iodine—; apothecia adnate, 0.3 to 1 mm. wide; disk dull black, flat to convex, with a concolorous, erect, horny margin, this at last disappearing; epithecium dark brown; thecium pallid, 100  $\mu$  high; paraphyses loosely coherent; hypothecium dark brown; asci saccate, 68  $\mu$  to nearly as high as the thecium, 24  $\mu$  thick; spores 2 in the asci, from colorless to gray and intensely brown black, 32 to 72  $\mu$  long, 20 to 36  $\mu$  thick, muriform; hymenial gelatine of an intense blue with iodine.

A montane lichen, rare below 300 meters elevation. Santa Cruz Mountains, *Herre*, at 1,260 meters; throughout the San Gabriel and San Bernardino Ranges; on Santa Catalina Island.

**CLADONIACEAE.**

Of the several genera classed in this family, the only one reported from our district is the following:

**CLADONIA Hiller.**

Thallus squamaceous to foliaceous, of two parts conveniently designated as horizontal or primary and erect or secondary, the latter of greatly varying size and shape, constituting the "podetia;" apothecia sessile upon the apices of the podetia or rims of the cups, rarely sessile directly upon the squamous or foliaceous primary thallus, biatorine, with a proper, but without a thalline margin; paraphyses simple, coherent; hypothecium pallid or colored; asci clavate, 6 to 8-spored; spores colorless, simple, ovoid, oblong to fusiform, rarely bilocular or trilocular; spermogones situated at the tips of the podetia or on the corresponding rims of the cups, exceptionally on the primary thallus; spermatia cylindric or acicular, nearly straight.

The species concerning us come under the subseries Ochrophaeae Wainio, of the subgenus *Cenomyce* (Ach.) T. Fries, briefly characterized by pallid or light brown apothecia, the podetia not cup-bearing or with cups at their tips; spores simple. In ours the apothecia are brown.



## KEY TO SPECIES.

Podetia not cup bearing.

- Dichotomously branching..... 1. *C. furcata racemosa*.  
 Corymbosely branching..... 2. *C. furcata corymbosa*.

Podetia cup bearing.

Cups well developed.

Cortex of cups and podetia verruculose.

- Cups more or less proliferous..... 7. *C. verticillata subcervicornis*.  
 Cups not or slightly proliferous.

- Primary thallus large..... 4. *C. pyxidata pocillum*.  
 Primary thallus not large..... 3. *C. pyxidata*.

Cortex of cups and podetia not verruculose.

- Granulose, pale sulphur-colored..... 5. *C. pyxidata chlorophaea*.  
 Furfuraceous, grayish white..... 11. *C. pityrea*.

Cups not well developed.

- Contracted; cortex finely pulverulent..... 8. *C. fimbriata simplex*.

Abortive or absent.

Podetia present, considerably developed.

- Podetia long, subulate..... 9. *C. fimbriata subulata*.  
 Podetia not subulate, clavate above. 10. *C. fimbriata clavata*.

- Podetia short or none; apothecia sessile. 6. *C. caespiticia*.

**1. *Cladonia furcata racemosa* Floerke.**

Primary thallus sparingly present, persistent, the squamules oblong, crenate, lobulate, light green above, white beneath; podetia moderately elongate, white above, ash or pinkish ash below, sparingly branched, branches erect or suberect, bifurcate below the tips, beset with crenulate squamules of the same color as the primary thallus, not pervious in the axils, KHO—, Ca (ClO)<sub>2</sub>—.

On earth at San Diego.

**2. *Cladonia furcata corymbosa* (Ach.) Nyl.**

Primary thallus evanescent; podetia 25 to 60 mm. high, white throughout, dichotomously divided above, the branchlets redivided and bearing small, globose, light brown apothecia at the ends of the corymbosely arranged terminations, the stem sparingly squamulose, beset with small to minute, entirely white squamules or the larger green above, with KHO pale yellow (only the squamules); hymenial gelatine with iodine blue soon turning yellow, the hypothecium, however, retaining the blue stain.

On earth near San Francisco, *Gray*; the same from Washington, *Foster*, very luxuriant, 1 cm. high, more sparingly squamulose, KHO—, Ca(ClO)<sub>2</sub>—; spores fusiform-ellipsoid, often slightly curved, 10 to 15  $\mu$  long, 3 to 4  $\mu$  thick; also the same from Santa Catalina Island.

**3. *Cladonia pyxidata* (L.) Hoffm.**

Primary thallus of small squamules, dull grayish green above, white beneath, crowded; podetia short, verruculose throughout; cups large, entire or proliferous marginally, the proliferations generally with brown globular apothecia.

Common in our territory and cosmopolitan.

**4. *Cladonia pyxidata pocillum* (Ach.) Flot.**

Primary squamules larger than in the species, of more somber color, appressed; podetia short.

On earth; near San Diego, *Alderson* (communicated by Parish). Rare with us.

**5. *Cladonia pyxidata chlorophaea* (Spreng.) Floerke.**

Primary squamules less spreading than in the species, whitish or pale sulphur-colored, granulate-pulverulent; cups regular, rarely proliferous.



On earth, Santa Monica Range; Santa Catalina Island; cosmopolitan like the species.

**6. *Cladonia caespiticia* (Pers.) Floerke.**

Primary thallus squamulose-foliaceous, laciniate-lobed and obscurely crenate, light green or light yellowish green above, beneath white, pulverulent; squamules densely crowded forming small cushions, erect, KHO—,  $\text{Ca}(\text{ClO})_2$ —; podetia and spermogonia not seen.

On earth at base of cliffs; apparently rare.

**7. *Cladonia verticillata subcervicornis* Wain.**

Primary thallus persistent, olive green above, white beneath; podetia short, not over 1 cm. high, greenish gray to light brownish, somewhat granular or occasionally beset with several small squamules; cup flat or slightly concave, with brown apothecia on the rim, separate or conglomerate, sometimes elevated on a short pedicel, a few cups with a short indication of an axial prolongation, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —.

On earth under shrubs at San Diego.

**8. *Cladonia fimbriata simplex* (Weiss) Wain.**

Primary thallus thick; squamules medium-large, light gray green above, white beneath; podetia short, not longer than 15 to 17 mm., whitish, finely pulverulent; cups narrow, from 1 to 2 mm. wide at the rim; apothecia not seen, KHO—,  $\text{Ca}(\text{ClO})_2$ —.

On ground among moss, Santa Catalina Island, in the San Gabriel and Santa Monica Ranges, and also near San Diego.

**9. *Cladonia fimbriata subulata* (L.) Wain.**

Primary thallus scarce; squamules small, broadly spatulate or rounded, crenate, olive green above, white beneath; podetia from 1 to barely 2 cm. high, simple, cream color, finely pulverulent, squamulose, not cup-bearing, acuminate and pointed at the apex; sterile.

Earth and rotten wood, Santa Cruz Mountains, *Herre*; shaded earth in the Santa Monica Range.

**10. *Cladonia fimbriata clavata* Arnold.**

Primary thallus evanescent; podetia longer than in the preceding varieties (2.25 cm.), whitish, finely pulverulent, more or less bluntly clavate above.

On moss-covered boulders, Topanga Canyon, Santa Monica Range.

**11. *Cladonia pityrea* (Floerke) Fries.**

Squamules small, lobate, brownish above, whitish beneath; podetia from 5 to 10 mm. high, whitish or light grayish, finely pulverulent; cups narrow, the rim denticulate or often irregular and proliferous, the dentations and proliferations fertile; apothecia small, dark brown.

On earth; frequent and dispersed throughout the district.

## GYROPHORACEAE.

Thallus of one or several fronds, attached centrally to the substratum, the medullary layer containing *Pleurococcus* gonidia; apothecia appressed, sessile or subpedicellate, having a proper, mostly carbonaceous margin; disk gyrate furrowed, rarely smooth; asci 1 to 8-spored; spores colorless or dark, simple or several-celled or muriform.

### KEY TO GENERA.

- Spores simple, eight in asci..... *GYROPHORA* (p. 60).  
 Spores muriform-multilocular, one or two in the asci..... *UMBILICARIA* (p. 61).



## GYROPHORA Ach.

Apothecia innate, sessile or almost pedicellate, circular, the proper margin dark, carbonaceous; disk commonly gyrose-plicate; paraphyses discrete; asci clavate or saccate-clavate; spores colorless, ellipsoid to oblong, simple; sterigma jointed; spermatia short, straight, cylindric.

## KEY TO SPECIES.

- Polyphyllous..... 2. *G. polyphylla*.  
 Monophyllous.  
   Ridged and rugulose above.  
     Frond without perforations..... 1. *G. rugifera*.  
     Frond with perforations.  
       Perforations numerous..... 4. *G. erosa*.  
       Perforations few..... 5. *G. torrefacta*.  
   Not ridged above.  
     Dark brown with a purple bloom..... 6. *G. angulata*.  
     Dark brown, bloom absent..... 3. *G. phaea*.

1. *Gyrophora rugifera* (Nyl.) T. Fries.

Monophyllous, rigid, 1 to 3 cm. wide, above deeply lacunose by prominent reticulated ridges, the surface finely areolate-granulose, yellowish brown at the center, becoming brown toward the border or brown throughout (a specimen from the Tehachapi Mountains with the upper surface turgidly rugose-plicate, of ash gray color with a delicate pale roseate tinge); beneath nearly of the same color as above but paler, the border crenulate and lobulate, neither cortex nor medulla affected by KHO, both turned red by  $\text{Ca}(\text{ClO})_2$ ; apothecia adnate-sessile, 0.25 to 1 mm. in diameter, grouped and crowded; disk black, obscurely gyrate, encircled by a more prominent gyration; epithecium brown, continuous; thecium  $80\ \mu$  high; paraphyses coherent; hypothecium dark reddish brown, as high as the thecium; spores ovoid, ellipsoid, and oblong-ellipsoid, 11 to  $15\ \mu$  long, 4 to  $6\ \mu$  thick.

On granitic rocks in the higher mountains; Mount San Antonio at 3,500 meters; San Bernardino and San Jacinto Mountains at 3,700 meters; Mount Cummings, Tehachapi Range, at 2,700 meters. Alpine. Northern Europe, Siberia.

2. *Gyrophora polyphylla* (L.) Borr. & Turn.

Monophyllous but oftener composed of a rosette of larger and smaller fronds, dark brown to black above, beneath smooth and in the center light brown gradually darkening toward the dull black periphery; border of the fronds entire to lacerate-crenate and lobed; apothecia innate and adnate, scattered or grouped, 0.25 to 1.5 mm. wide; disk black, gyrose, soon angular and lunette-shaped, a turgid, glistening gyration following the outline of the disk inclosing several thinner gyrations, KHO—,  $\text{Ca}(\text{ClO})_2$ + reddish or —; epithecium subcontinuous, dark brown; thecium  $112\ \mu$  high, colorless or tinted faint yellowish brown; paraphyses lax-coherent; hypothecium pale yellowish, nearly half the height of the thecium; asci inflated-clavate, the membrane stout; spores oblong ovoid ellipsoid, 12 to  $17\ \mu$  long, 6 to  $8\ \mu$  thick; hymenial gelatine with iodine dark reddish brown.

Sandstone, Devils Canyon, Santa Cruz Mountains, at 780 meters, *Herre*; Tehachapi Range at 1,500 meters.

3. *Gyrophora phaea* (Tuck.) *Herre*, Proc. Washington Acad. Sci. 7: 366. 1906.

*Umbilicaria phaea* Tuck. Lich. Calif. 15. 1866.

Monophyllous, dark brown and blackening above, smooth, beneath delicately granulose and at point of attachment radiately trabeculose, generally of lighter brown than above, though now and then dull black, from 0.5 to not over 2 mm. wide, the periphery entire to coarsely crenulate and lobulate, KHO,  $\text{Ca}(\text{ClO})_2$ ± red; apothecia



innate, on a level with or barely projecting above the surface of the frond, generally crowded near the border; disk black, gyrose-plicate, round or incurved-angled; epithecium continuous, brown; thecium dilute yellowish brown, 54 to 60  $\mu$  high; paraphyses coherent; hypothecium brown like the epithecium; asci inflated-clavate, 36 to 40  $\mu$  long, 18 to 20  $\mu$  thick; spores broadly ovoid, 10 to 16  $\mu$  long, 6 to 8  $\mu$  thick; hymenial gelatine pale blue with iodine.

Frequent in the mountains, ascending from the lower ranges. On granitic and other rocks in the Santa Monica and throughout the higher ranges of southern California. San Bernardino Mountains, *Parish*.

#### 4. *Gyrophora erosa* (Weber) Ach.

Monophyllous, rigid, brown above, delicately reticulate-rimose, the rimæ perforating the frond by numerous minute openings, the border crenate or finely erose, beneath lighter in color or darker and blackening, granulose, naked or a few fibrillæ toward the periphery, KHO—,  $\text{Ca}(\text{ClO})_2=$ , 2.5 to 5 cm. in diameter. The apothecia, spores, etc., do not differ from those of the next following species.

On rocks, Yosemite Valley, which is, so far as known, the southern limit in California. A lichen of arctic regions and the higher mountains of the northern United States; Europe; northern Asia.

#### 5. *Gyrophora torrefacta* Cromb.

Monophyllous, above a rich, dark reddish brown, less cribose and less erose at the periphery than *G. erosa*, thus appearing rather entire, the upper surface broadly turgid-rugulose, beneath brown black, coarsely papillate, often stoutly trabeculate, the fibrillæ less evident or wanting, KHO=,  $\text{Ca}(\text{ClO})_2\mp$ reddish; apothecia sessile, elevated, brittle; disk black, gyrose-plicate; epithecium subcontinuous, brown; thecium 44 to 48  $\mu$  high, pale yellowish brown; paraphyses adglutinated; hypothecium brown; asci clavate and inflated-clavate; spores ovoid, bluntly ellipsoid, 10.5 to 12  $\mu$  long, to 8  $\mu$  thick; hymenial gelatine blue with iodine.

On rocks growing with the last preceding species and easily confounded with it.

#### 6. *Gyrophora angulata* (Tuck.) Herre, Contr. U. S. Nat. Herb. 13: 318. 1911.

*Umbilicaria angulata* Tuck. Proc. Amer. Acad. 1: 266. 1847.

Monophyllous, smooth, black brown (in southern California) or with a purple bloom (from Siskiyou County), lobed and coarsely crenate at the periphery, from 1 to 2.5 cm. wide, beneath dark brown to dull black, areolate to coarsely papillate; apothecia innate to adnate, irregularly star-shaped to pluriangular; disk black, gyrose; epithecium subcontinuous, brown; thecium colorless or pale yellow tinted, about 70  $\mu$  high; paraphyses coherent; hypothecium brown, darker than the epithecium; asci clavate, 60  $\mu$  long, 15  $\mu$  thick; spores ovoid, 16 to 20  $\mu$  long, 8 to 10  $\mu$  thick; hymenial gelatine with iodine blue, with KHO violaceous, no change with  $\text{NO}_5$ . The color above and condition of thallus beneath varies, but the characteristic shape of the apothecia is constant.

On rocks; Siskiyou County, *Baker*; granite boulders at Tehachapi.

### UMBILICARIA Hoffm.

Spores muriform, colorless or decolorate, one or two in the asci.

#### 1. *Umbilicaria semitensis* Tuck.

Monophyllous, above uniform mouse-colored to brown, delicately rimose, the border involute, entire or lacerate-lobed, KHO=;  $\text{Ca}(\text{ClO})_2=$ ; KHO+ $(\text{CaClO})_2$ , the medulla faint red; apothecia adnate-sessile, 0.25 to 3 mm. in diameter, dispersed over outer part of frond; disk black, glistening, gyrate, round to obtusely angular, an entire or interrupted gyration encircling it; epithecium continuous, brown; thecium about 120  $\mu$  high, pale yellowish brown; paraphyses coherent; hypothecium brown; asci inflated-clavate to ventricose, about 100  $\mu$  long, 36  $\mu$  thick, the membrane thick throughout;



spores 8, ovoid and broadly ellipsoid, colorless to decolorate, 20 to 28  $\mu$  long, 14 to 20  $\mu$  thick; hymenial gelatine with iodine blue, the spores yellow.

On boulders near Tehachapi Station at 1,300 meters altitude; at Camp Baldy, San Antonio Canyon, in the San Gabriel Range at 1,500 meters.

### ACAROSPORACEAE.

Thallus crustaceous, squamous, or foliaceous, often scantily developed; gonidia Protococcus or Pleurococcus; apothecia imbedded in the thalline squamæ, sessile or subpedicellate; disk circular, often narrowed or irregular, lecideine, biatorine, or lecanorine; asci multisporous; spores simple, commonly ellipsoid, rarely globular, colorless; spermatia oblong-ellipsoid, on a subsimple sterigma.

#### KEY TO GENERA.

- Apothecia with a proper margin, biatorine or lecideine... BIATORELLA (p. 62).  
 Apothecia lecanorine..... ACAROSPORA (p. 63).

### BIATORELLA De Not.

Thallus crustaceous, uniform or subeffigurate at the circumference or obsolete; apothecia biatorine or lecideine, the proper margin devoid of thallus, with Pleurococcus gonidia, the apothecia innate, sessile or subpedicellate, circular.

#### KEY TO SPECIES.

- Substratum bark or wood..... 4. *B. moriformis*.  
 Substratum rock.  
   Thallus effuse, indistinct..... 5. *B. hypophaea*.  
   Thallus obsolete.  
     Apothecia stipitate..... 3. *B. clavus*.  
     Apothecia, sessile.  
       Disk pruinose, black..... 1. *B. pruinosa*.  
       Disk not pruinose, black..... 2. *B. simplex*.

#### 1. *Biatorella pruinosa* (J. E. Smith) Mudd.

Thallus obsolete or a few inconspicuous granules clustered around the apothecia; apothecia adnate, clustered or dispersed, 0.25 to 0.5 mm. in width; disk flat, dull black, pruinose (blackening when moist) with a permanent, thin, regular or wavy, concolorous margin; epithecium dark brown, continuous; thecium colorless, 56 to 60  $\mu$  high; paraphyses free, adglutinated only at the apices, scarcely thickened above, the tips pale brownish; hypothecium pallid amber yellow; asci oblong-ellipsoid, thickened above, about equaling the thecium in height; spores minute and numerous, 3 to 4  $\mu$  long, barely 1  $\mu$  thick; hymenial gelatine with iodine sordid greenish blue, the thecium and hypothecium blue and of darker shade than the thecium, the ascus wall not stained, but its contents yellow.

On quartzose and other rocks. Sandstone in the Santa Cruz Mountains, *Herre*; frequent on quartz in the Santa Monica Mountains; in the San Bernardino Mountains, *Parish*.

An epruinose state (forma *nuda* Nyl.) is found occasionally with the species, the apothecia barely or not at all pruinose, sessile, somewhat larger than in the species, the disk convex with a persistent, concolorous margin, the thecium 80 to 100  $\mu$  high, colorless, the spores 4 to 5  $\mu$  long, about 1  $\mu$  thick.

#### 2. *Biatorella simplex* (Davies) Branth & Rostr.

Thallus absent; apothecia sessile, 1 mm. or less wide, disk dark brown black, round or angular, turgid-papillate, surrounded by a concolorous, similarly turgid and inter-



rupted margin; epithecium continuous, yellowish brown, gradually paling downward; thecium colorless, 120 to 130  $\mu$  high; paraphyses slender, coherent, the slender brown tips scarcely thickened; hypothecium *pallid*, pale grayish yellowish, about as high as the thecium; asci oblong, thickened at top; spores minute and numerous, oblong-ellipsoid, 4 to 6  $\mu$  long, 1 to 1.5  $\mu$  thick; hymenial gelatine blue with iodine.

On various rocks in the Santa Monica and San Gabriel Ranges; at Del Mar on quartz pebbles. Europe; northern Africa; eastern Asia.

### 3. *Biatorella clavus* (Lam. & DC.) T. Fries.

Thallus absent; apothecia short-stipitate, large, from 1 to 3 mm. wide, dispersed or sometimes several congregated; disk flat, black (retaining that color when moistened), roughly papillate, naked; margin thick, persistent, crenate, following the sinuosities of the irregularly formed disk; epithecium continuous, orange to reddish brown, paling downward; thecium 160  $\mu$  high, colorless; paraphyses strict, subcoherent; hypothecium *brown*; asci inflated-clavate, the membrane thickened at apex; spores minute and numerous, oblong-ellipsoid, 3 to 4  $\mu$  long, 1 to 1.5  $\mu$  thick; asci with iodine staining a dilute claret red, the thecium and paraphyses reddish brown.

Frequent on rocks throughout our mountains. Eastern and southern United States; Europe.

### 4. *Biatorella moriformis* (Ach.) T. Fries.

Thallus indistinct and obsolete; apothecia small, sessile; disk planoconvex, dark brown and blackish, the margin entire, light colored; epithecium subcontinuous, light brown; thecium colorless, 68 to 80  $\mu$  high; paraphyses separate, not sharply defined, not or scarcely thickened at the tips; hypothecium colorless; asci pyriform or saccate, 60  $\mu$  long, 28 to 42  $\mu$  thick, including the quite thick membrane; spores spherical, numerous, small, 2 to 3.5  $\mu$  in diameter; hymenial gelatine with iodine blue, becoming sordid brown;  $\text{NO}_3$  changing the epithecium to yellow.

On bark of *Pseudotsuga macrocarpa*, Tehachapi Mountains near "Lone Pine Mine," at 1,600 meters. On *Aesculus californica* in Alameda County, Gray. Northeastern United States, north and west to Canada and Washington; Europe.

### 5. *Biatorella hypophaea* (Nyl.).

*Lecanora hypophaea* Nyl. Flora 53: 34. 1870.

Thallus effuse, indistinct, granular-pulverulent,  $\text{KHO}$ —,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.25 to 1 mm. wide; disk flat to lightly convex, faintly papillate, reddish black, mostly round, the margin permanent, entire or slightly wavy, somewhat shining; epithecium continuous, dark brown gradually paling downward, 30 to 32  $\mu$  high; thecium colorless, translucent 94 to 100  $\mu$  high, including the colored epithecium; paraphyses slender, strict, some clavate and colored at the tips; hypothecium pallid yellowish in the center, pale brown toward the circumference; asci oblong-ellipsoid; spores minute and numerous, oblong, apparently slightly thickened at both ends, 5 to 7  $\mu$  long, 1.5  $\mu$  thick; thecium staining brownish yellow with iodine, the asci brown.

On crumbling sandstone, Santa Monica Mountains.

## ACAROSPORA Mass.

Thallus crustaceous, radiate-squamulose, with some tendency to lobation at the periphery, rarely uniform; apothecia at first immersed, then sessile; disk round or now and then narrow and irregular, surrounded by a thalline margin containing *Protococcus* gonidia; spores simple, colorless, small and numerous; paraphyses unbranching, jointed; spermatia oblong-ellipsoid.



## KEY TO SPECIES.

Substratum earth.

Thallus of convex squamules.

Squamules brown, wrinkled..... 9. *A. obpallens*.

Squamules whitish, furfuraceous.

Spores globular or subglobular, 4 to 6  $\mu$  in diameter. 7. *A. pleistospora*.Spores globular or subglobular, 10 to 13  $\mu$  in diameter. 8. *A. pleiospora*.

Thallus squamules not convex, flat.

Greenish yellow..... 3. *A. schleicheri*.Whitish..... 6. *A. reagens*.

Substratum rock.

Squamules some shade of yellow.

Citrine yellow..... 1. *A. chlorophana*.Greenish yellow..... 2. *A. xanthophana*.

Squamules some color other than yellow.

Squamules brown.

Squamules wrinkled..... 9. *A. obpallens*.

Squamules not wrinkled.

Disk not punctiform, becoming dilated..... 12. *A. fuscata*.

Disk punctiform, immersed.

Squamules dark beneath..... 11. *A. rufescens*.Squamules pallid beneath..... 10. *A. squamulosa*.

Squamules light-colored.

Squamules ochroleucous.

Disk small, pruinose, the squamules flat..... 13. *A. aeruginosa*.Disk not pruinose, the squamules semiglobular 14. *A. glebosa*.

Squamules white or whitish.

Deeply fissured, ivory whitish..... 4. *A. peltasticta*.Not deeply fissured, more or less blackish  
suffused..... 5. *A. epilutescens*.**1. *Acarospora chlorophana* (Wahl.) Mass.**

Thallus citrine yellow, closely adherent to substratum by medullary hyphæ, rimose-areolate in the center, the areolæ flattened-globose, radiate at the circumference, turgid, contiguous, dilating outward and at the periphery deeply lobed, hypothallus indistinct,  $\text{KHO} =$ ,  $\text{Ca}(\text{ClO})_2 =$ ; apothecia immersed, from punctiform to 0.5 mm. wide; disk flat to convex, light gamboge yellow; proper margin hidden by the thalline margin; epithecium continuous, sulphur yellow; thecium colorless, 60 to 80  $\mu$  high; paraphyses lax-coherent, slightly thickened at the yellow tips, not jointed or branched; hypothecium colorless; asci inflated-clavate, membrane thickened at top, 60 to 80  $\mu$  long, 20 to 26  $\mu$  thick; spores numerous and minute, ellipsoid, 3 to 4.5  $\mu$  long, approximately 1 to 1.5  $\mu$  thick; hymenial gelatine with iodine blue, except the epithecium, this not stained.

Throughout the mountains of southern California above 1,600 meters altitude, on granite and gneiss; San Bernardino Mountains, *Parish*; San Gabriel and San Jacinto Mountains.

**2. *Acarospora xanthophana* (Nyl.) Fink, Contr. U. S. Nat. Herb. 14: 170. 1910.**

*Lecanora xanthophana* Nyl. Ann. Sci. Nat. IV. Bot. 15: 379. 1861.

Crust greenish yellow, closely adherent, of turgid, flattish squamules, discrete or contiguous, lobed, rounded or angular from juxtaposition, from 0.5 to 2 mm. wide; apothecia innate, generally single in the squamules; disk punctiform to enlarged, flat, sordid brownish and blackening, the thalline margin entire or crenulate; epithecium pale yellowish; thecium 120 to 140  $\mu$  high; paraphyses not or slightly thickened at the tips, not colored; hypothecium colorless; asci saccate, 120  $\mu$  long, 28  $\mu$  thick; spores minute and numerous, 4 to 6  $\mu$  long, 2  $\mu$  thick; hymenial gelatine with iodine pale blue.



On sandstone and rocks, Santa Cruz Mountains, *Herre*; San Bernardino Mountains, *Parish*; present in the Santa Monica Range, mostly at lower altitude than the last preceding species. Eastern and southern United States and throughout the Pacific Coast States; in the petrified forest of Arizona.

Form *dealbata* Tuck, with flat to convex white squamules and a black disk, occurs sparingly on argillaceous rocks in the Santa Monica Mountains.

**3. *Acarospora schleicheri* Mass.**

Crust of yellow or greenish yellow squamules, generally crowded, flat or rugose, lobate or coarsely crenate, forming round patches from 2 to 5 cm. in diameter, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia innate, 0.25 to 1 mm. wide; disk flat to barely convex, brownish black, papillate with a crenate thalline margin; epithecium continuous, yellowish brown; thecium 92  $\mu$  high, colorless or tinted faint yellow; paraphyses strict, coherent; asci inflated-clavate, 68 to 72  $\mu$  high, thickened at top; spores minute and numerous, globose, 3 to 4  $\mu$  in diameter; hymenial gelatine with iodine blue, turning brown.

On earth; Santa Monica and Verdugo Ranges at lower elevations; Point Loma near San Diego; Santa Catalina Island; Elsinore, Riverside County; San Bernardino, *Parish*. Western United States; Europe; northern Africa.

**4. *Acarospora peltasticta* Zahlbr. Beih. Bot. Centralbl. 13: 161. 1902.**

Thallus of round subglobular, dull ivory white squamules, 2 to 4 mm. wide, rimose-areolate, the areolæ angular, pyramidal or truncate, erect, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia one to several in a squamule, immersed, small, the disk black; epithecium continuous, light yellowish brown; thecium colorless, about 120  $\mu$  high; paraphyses slender, coherent and adglutinated at the apices and these scarcely thickened or colored; hypothecium yellowish; asci oblong-ellipsoid, about equaling the thecium in height, the membrane but little thickened above; spores small, numerous, spherical, oval or obovoid, 4 to 5  $\mu$  in diameter or 5  $\mu$  long, 3.5  $\mu$  thick; hymenial gelatine with iodine blue, the thecium sordid yellow green, the epithecium not affected by the reagent, the hypothecium staining persistently blue.

On crystalline rocks. San Nicolas Island, *Trask*; on granite at the base of the San Jacinto Mountains, near Palm Springs (the type locality); at Elsinore, Riverside County; Grand Canyon, Arizona.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**5. *Acarospora epilutescens* Zahlbr. Beih. Bot. Centralbl. 13: 161. 1902.**

Thallus of turgid, semiglobose squamules, round or oblong, 1 to 2 mm. wide, contiguous or dispersed, whitish, ashy or light steel gray or light brown latterly, and white-suffused above, the squamules often marked by black fissures and short black ramifying or radiating capillary lines, giving the thallus to the naked eye a dark appearance, KHO—,  $\text{Ca}(\text{ClO})_2$ —; epithecium continuous, yellowish or brownish yellow to brown; thecium 120 to 170  $\mu$  high, colorless; paraphyses thin, loosely adglutinated, pale yellow and barely thickened at the tips; hypothecium colorless or very faint amber color, about one-quarter the height of the thecium; asci oblong-ellipsoid; spores minute and numerous, globular and ovoid, 3.5  $\mu$  long, 2.5 to 3  $\mu$  thick; hymenial gelatine with iodine blue, the thecium dark blue, the epithecium remaining unstained.

On granite. Type locality, Palm Springs at the eastern base of the San Jacinto Mountains.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**6. *Acarospora reagens* Zahlbr. Beih. Bot. Centralbl. 13: 162. 1902.**

Thallus squamulose, white and white pruinose, lobed at the circumference, centrally rimose-areolate, turgid, KHO  $\pm$  brick red,  $\text{Ca}(\text{ClO})_2$  =, medullary hyphæ with iodine —; squamules discrete but often contiguous and forming white patches on the ground; apothecia round, one or more in a squamule, innate or slightly elevated



above the thallus, 1 to 1.5 mm. in diameter; disk flat, papillate, dark blackish red, when moistened dark brick red and the thallus gray, a raised, crenulate, thalline rim forming a spurious margin; epithecium continuous, brick red to brownish red, gradually paling downward; thecium pallid sordid yellowish, about  $130\ \mu$  high; paraphyses adglutinated, coarse, not well defined, slightly thickened at the yellowish tips; hypothecium pale amber color; asci oblong-ellipsoid, reaching to the epithecium; spores numerous, globular, 5 to  $6\ \mu$  thick; hymenial gelatine handsome blue with iodine, the epithecium remaining unchanged; with KHO no reaction.

On sandy earth near Palm Springs at eastern base of the San Jacinto Mountains (the type locality).

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**7. *Acarospora pleistospora* (Nyl.).**

*Lecanora pleistospora* Nyl.; Hasse, Bull. Torrey Club **24**: 446. 1897.

Thallus of sordid white to ash gray, entire, subglobular squamules, generally crowded, 1.5 to 1.75 mm. wide, the apex coarsely pruinose and forming a white somewhat coarctate thalline margin, the thallus KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecium solitary, immersed in the squamule, 0.3 to 0.75 mm. wide; disk concave, round, dark brown black; epithecium continuous, yellowish brown to brown; thecium colorless, 120 to  $140\ \mu$  high; paraphyses slender, loosely coherent, not thickened at apices; hypothecium thin, pale amber color; asci ventricose, equaling the thecium in height; spores globular, numerous, 24 or more, 4 to  $6\ \mu$  in diameter; hymenial gelatine with iodine blue, the yellowish epithecium remaining unchanged; no change with KHO.

On earth. Type locality, the foothills near the Soldiers' Home, Santa Monica; Verdugo Mountains, near Los Angeles.

Type deposited with Doctor Nylander; duplicate in herb. Hasse.

**8. *Acarospora pleiospora* (Nyl.).**

*Lecanora pleiospora* Nyl.; Hasse, Bull. Torrey Club **27**: 446. 1897.

Thallus crustaceous, of sordid white to light gray, round, subglobular squamules, dispersed, 1.5 to 1.75 mm. in width, with coarse scaly pruina, attached to substratum by medullary hyphæ, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia single in squamules, immersed, 0.3 to 0.75 mm. in width; disk concave, dark brown to black, the thalline margin somewhat coarctate; epithecium continuous, sordid yellowish; thecium  $300\ \mu$  high, sordid pallid; paraphyses slender, subcoherent, containing numerous minute globules, conglutinated at the apices; hypothecium pale sordid yellow; asci saccate,  $240\ \mu$  long,  $48\ \mu$  thick; spores globular, 10 to  $13\ \mu$  in diameter; hymenial gelatine with iodine blue, then reddish brown; spermogones not seen.

On earth. Type locality in the San Gabriel Range, at 700 meters altitude, along the "New Trail" to Mount Wilson. In external appearance this is very similar to the last preceding species, differing in the size of the spores.

Type deposited with Doctor Nylander; duplicates in the United States National Herbarium and in herb. Hasse.

**9. *Acarospora obpallens* (Nyl.) Zahlbr. Beih. Bot. Centralbl. **13**: 161. 1902.**

*Lecanora obpallens* Nyl. Act. Soc. Sci. Fenn. **26**: 31. 1890.

Thallus of discrete or crowded squamules, light chestnut, shining, slightly rugulose and pitted, convex, round, from 1 to 1.8 mm. wide; apothecia solitary in squamules, from primarily almost punctiform to 0.5 and 0.75 mm. in diameter; disk concave to flat, reddish brown, papillate, naked or slightly pruinose, with a thin, entire, persistent thalline margin; epithecium subcontinuous, pale yellowish brown to brown; thecium pallid; hypothecium pallid; paraphyses slender, coherent at the globular brown tips; asci inflated-clavate, extending up to the epithecium, the membrane thick, especially above; spores minute and numerous, oblong, 4 to  $7\ \mu$  long,  $1\ \mu$  or less than  $2\ \mu$  thick; hymenial gelatin blue with iodine, turning vinous red, no change with KHO or  $\text{NO}_5$ .



On earth and crumbling sandstone. Type locality, foothills of the Santa Monica Range near the Soldiers' Home. Widely distributed in the State; Santa Cruz Peninsula, *Herre*; Santa Catalina Island; Mill Creek Canyon, San Bernardino Mountains; Palm Springs at foot of San Jacinto Mountains.

Type deposited in the U. S. National Herbarium; duplicates in the herbarium of New York Botanical Garden, with Dr. A. Zahlbruckner, and in herb. Hasse.

A parasite inhabits occasionally the thallus of *A. obpallens*. Small black, globular, sessile, erect bodies on the surface of the squamules, the perithecium dark brown black, parenchymatous, the inner membrane apparently colorless; asci obliquely lanceolate, 40 to 44  $\mu$  long, 14  $\mu$  thick; spores 8, colorless, bilocular, 11 to 12  $\mu$  long, 3.5 to 4  $\mu$  thick; paraphyses absent.

**10. *Acarospora squamulosa* (Schrad.) T. Fries.**

Crustaceous, brown, of flat or convex, rounded and sublobulate or entire, crowded or dispersed squamules, beneath whitish, KHO—, Ca(ClO)<sub>2</sub>—; apothecia impressed, small; disk flat, black, with a thick, entire thalline margin; epithecium continuous, light brown; thecium 120  $\mu$  high; paraphyses separate or loosely coherent, not thickened nor colored at the tips, simple, entire; hypothecium colorless, equaling the thecium in height; asci saccate, 100  $\mu$  long, 24  $\mu$  thick; spores very minute and numerous; hymenial gelatine blue then brown with iodine.

On various rocks. Frequent in the Santa Monica Range.

**11. *Acarospora rufescens* (J. E. Smith) T. Fries.**

Thallus of light or dark chestnut brown squamules, these crowded and imbricated or more dispersed, wavy and lobate in outline, undulate, not closely adnate to the substratum, somewhat shining, *beneath black*, no reaction with KHO or Ca(ClO)<sub>2</sub>; apothecia immersed, small, flat to at last larger and concave, reddish brown; epithecium continuous, pale straw color; thecium colorless, about 120  $\mu$  high; paraphyses stout, about 2  $\mu$  thick, loosely coherent, entire, simple, not or but slightly thickened at apices and finally tinted pale yellow; hypothecium colorless or with a faint yellow tint and equaling the thecium in height; asci inflated-clavate, 100 to 116  $\mu$  long, 26 to 28  $\mu$  thick, membrane much thickened at upper part; spores very minute and numerous, oblong, 3 to 4  $\mu$  long, 1  $\mu$  thick; hymenial gelatine pale blue, the hypothecium darker and the ascus contents greenish yellow with iodine.

On granite, San Bernardino Mountains at 3,000 meters altitude; Santa Cruz Mountains, *Herre*.

**12. *Acarospora fuscata* (Schrad.) Arnold.**

Thallus crustaceous, dark brown, rimose-areolate, beneath dark; apothecia innate; disk primarily small, at last enlarging and occupying nearly the entire areole, from concave to flat and level with the thallus, dark brown; epithecium yellowish brown to brown, continuous; thecium 92 to 96  $\mu$  high, colorless; paraphyses moderately stout, loose but adglutinate at the tips, these scarcely thickened, yellowish brown; hypothecium pale amber color; asci inflated-clavate, the membrane thickened above, nearly reaching the epithecium; spores very minute and numerous; hymenial gelatine with iodine blue, the epithecium remaining unstained; thecium soon greenish blue, the hypothecium persistently blue.

On rocks. From various localities in the Santa Cruz Peninsula, *Herre*; on sandstone in the Santa Monica Range. Arctic America and northern United States; Europe.

**13. *Acarospora aeruginosa* Hasse, sp. nov.**

Thallus squamulose, the squamules flattened-convex, contiguous or dispersed, clay-colored, 0.25 to 0.5 mm. wide, KHO (Ca(ClO)<sub>2</sub>)—, semitranslucent when moist; apothecia central, immersed; disk depressed, flat, pale greenish or pale bluish pruinose, about 0.1 to 0.15 mm. wide; epithecium granulose, colorless; paraphyses capillary,



simple, entire, loose, not thickened above; hypothecium colorless; thecium 140 to 150  $\mu$  high, colorless; asci inflated-clavate, the membrane thin without thickening of the upper part, about equaling the thecium in height; spores minute, numerous, oblong, 3 to 4  $\mu$  long, barely 1  $\mu$  thick; hymenial gelatine with iodine blue throughout, darkest at upper part.

On argillaceous shale, Santa Monica Range. Type locality, foothills near the Soldiers' Home.

Type deposited in herb. Hasse.

#### 14. *Acarospora glebosa* Koerb.

Thallus of round, reddish brown, convex squamules not exceeding 1 mm. in width, scattered or approximate, the squamules in the latter case becoming angular and rimose; apothecia small, punctiform, depressed, generally single, rarely two in a squamule, the disk at last slightly enlarged and concave, dull black with a rim of thalline margin; epithecium continuous, dark reddish brown; thecium colorless, about 120  $\mu$  high, stained blue with iodine, particularly the hypothecium being dark blue, the epithecium showing no reaction; paraphyses moderately stout, loosely coherent but adglutinated at the tips; hypothecium colorless; asci ventricose, the membrane thickened at the top, 100  $\mu$  long, 36  $\mu$  thick; spores 24 in each ascus, bluntly ellipsoid, 11 to 18  $\mu$  long, 5 to 8  $\mu$  thick; Protococcus gonidia forming a thick sub-cortical layer extending also under the hypothecium.

On sandstone, Santa Monica Range. Outwardly very similar to a *Heppia*.

### PYRENOPSISIDACEAE.

Thallus crustaceous (in our species), dark, dull black; apothecia urceolate or expanded; parathecium and hypothecium well developed or obsolete; paraphyses gelatinous, not branched nor jointed; asci 8 to many-spored; spores colorless, ovoid-ellipsoid to globular, simple, rarely bilocular; spermatia ovoid, oblong to acicular, straight or curved.

Of the genera classed with this family we have only the following:

#### PSOROTICHIA Mass.

Crust granular-areolate; gonidia consisting of *Xanthocapsa* algæ, the cells round, blue green, clothed with a yellowish to yellow brown gelatine; apothecia immersed and urceolate, finally opening, furnished with a proper and a lecanorine margin; paraphyses few, slender, adglutinated or separate; asci 8-spored, exceptionally 4 to 32-spored; spermatia oblong-ellipsoid.

#### KEY TO SPECIES.

Growing on earth.

Contiguous squamules forming green black patches..... 1. *P. segregata*.

Growing on rock.

Squamulose; squamules lobate, forming small green cushions. 3. *P. squamulosa*.

Not squamulose.

Forming coralloid black patches..... 2. *P. arnoldiana*.

Crustaceous.

Green black, areolate-rimose..... 4. *P. schaereri*.

Dark brown, coarsely granulose..... 5. *P. phaeococca*.

#### 1. *Psorotichia segregata* (Nyl.).

*Collemopsis segregata* Nyl.; Hasse, Lich. South. Calif. 6. 1898.

Crustaceous thallus blackish green, the small patches not over 1 cm. in diameter, without rhizinae, homogeneous with submoniliform blue green gonidia; the thallus almost entirely covered by the apothecia, these 0.2 mm. wide, at first urceolate with



turgid thalline margin, the disk finally immarginate, planoconvex, dull reddish; epithelial structure absent, replaced by the free apices of the slender, loose, adglutinate paraphyses; thecium colorless, 132 to 140  $\mu$  high; hypothecium amber color, about 40  $\mu$  high; asci oblong-cylindric, nearly of the height of the paraphyses; spores 8, oblong-ellipsoid, 16 to 18  $\mu$  long, 10 to 11  $\mu$  thick; hymenial gelatine with iodine a sordid pale blue, the pale yellow stained apices of the paraphyses protruding above the epithecium; sterigma simple, straight; spermatia small, oval, about 2  $\mu$  long, and less than 1  $\mu$  thick.

On earth, foothills of the Santa Monica Range near the Soldiers' Home, the type locality.

**2. *Psorotichia arnoldiana* (Hepp) Koerb.**

Crust blackish, thin, coralloid-crustaceous, loosely attached without true rhizinae, forming small patches about 1 cm. in diameter; gonidia blue green, round or oval, 4 to 12  $\mu$  in diameter, the larger irregular or ovoid, scattered; apothecia numerous, small, globular, urceolate; epithelial structure indistinct; thecium colorless, 100 to 140  $\mu$  high; paraphyses slender, loose, imbedded in hymenial gelatine, their apices free, not thickened nor colored; hypothecium pallid; asci cylindric and oblong-cylindric, about half the height of the thecium; spores 8, simple, oblong or obovate-ellipsoid, 15 to 24  $\mu$  long, 9 to 12  $\mu$  thick; hymenial gelatine with iodine blue, turning brown.

Among moss on soft disintegrating sandstone in the Strawberry Valley, San Jacinto Mountains, at 1,650 meters altitude.

**3. *Psorotichia squamulosa* Zahlbr. Beih. Bot. Centralbl. 13: 158. 1902.**

Thallus of dull black or dark olive green, cartilaginous, round-lobate squamules, forming small cushions; apothecia minute, immersed in thalline warts; disk concave, brown; paraphyses imbedded in hymenial gelatine, reddish brown and hardly thickened above; asci tubular, about 80  $\mu$  long; spores 16 in asci, ellipsoid, simple, 9 to 12  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine light blue with iodine turning yellow; hypothecium brownish yellow.

In crevices of disintegrating granite at Palm Springs, the type locality. Type in the hands of Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**4. *Psorotichia schaeereri* (Mass.) Arnold.**

Thallus almost black, forming an areolate-rimose or areolate-diffract, coarsely granular to coralloid, thin crust; apothecia numerous, from quite small to at length 0.5 to 0.8 mm. wide, sessile; disk at first immersed, finally flat, round, black, slightly papillate, with a persistent, crenulate, concolorous proper margin, the apothecia and thallus forming a black crust to the unaided eye; epithecium continuous, pale brownish yellow, gradually fading downward; thecium 80 to 100  $\mu$  high, in places colorless but mostly yellowish brown of the same hue as or darker than the epithecium; paraphyses adglutinate, slightly clavate at the tips; hypothecium golden or orange brown, about half the height of the thecium; asci clavate and inflated-clavate, about equaling the thecium in height; spores 8, oblong-ellipsoid, simple, colorless, 12 to 18  $\mu$  long, 7 to 9  $\mu$  thick; hymenial gelatine with iodine blue, the hypothecium darker than the thecium, the epithecium not changed by the reagent; gonimia all light blue green with a thin membrane and without a gelatinous capsule, round or ovoid, 4 to 8  $\mu$  in diameter, sometimes two joined at the flattened sides, 8 to 12  $\mu$  in diameter, or even four cohering, scattered.

On sandstone and argillaceous shale in the Santa Monica Range.

**5. *Psorotichia phaeococca* (Tuck.).**

*Synalissa phaeococca* Tuck. Gen. Lich. 80. 1872.

Thallus a coarsely granular, black brown crust, the granules separate or contiguous; apothecia numerous, small, globular, sessile, 0.2 to 0.5 mm. in diameter; disk sordid brick red, at first impressed, then larger, concave, with an entire proper margin concolorous with the disk; epithecium continuous, yellow; thecium 120  $\mu$  high, colorless,



with iodine blue; paraphyses coherent, simple, entire, not clavate nor colored at the tips; hypothecium paler yellow than the epithecium, about  $60\ \mu$  high, asci inflated-clavate, equaling the thecium in height, the membrane thickened above; spores broadly ovoid-ellipsoid, 19 to  $21\ \mu$  long,  $12\ \mu$  thick, indistinctly bilocular; septation plainer after KHO, the spore then sometimes trilocular.

Sandstone, Santa Monica Range.

### EPHEBACEAE.

Thallus dwarf-fruticulose, terete and closely branching or foliaceous; symbionts *Scytonema* or *Stigonema* algæ. In our district represented only by one genus of the several classed here by authors.

### POLYCHIDIUM Ach.

Thallus foliaceous, deeply lobate and incised, appressed or ascending, or fruticulose with terete ramifications, naked or ciliolate; gonidia concatenate, consisting of *Scytonema* algæ; apothecia sessile, biatorine, red-brown, the disk flat to convex; paraphyses not branched, coherent and thickened at the tips; asci clavate, 8-spored, the spores fusiform-oblong, bilocular; spermatia short, cylindric.

#### KEY TO SPECIES.

- Thallus foliaceous..... 1. *P. albociliatum*.  
Thallus fruticulose..... 2. *P. muscicola*.

1. *Polychidium albociliatum* (Desmaz.) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 157. 1907.

*Leptogium albociliatum* Desmaz. Ann. Sci. Nat. IV. Bot. 4: 132. 1855.

Thallus foliaceous, olive green, elongate; lobed border of thallus crenate, finely lacinate and fringed with a row of short white ciliæ extending onto the under surface; apothecia sessile, 0.5 to 1 mm. wide, disk flat or slightly convex, brownish red, with an entire, indistinct, lighter colored margin; epithecium continuous, faint yellow, gradually paling downward; thecium  $72$  to  $100\ \mu$  high, colorless or faintly tinted similar to the epithecium; paraphyses adglutinated, somewhat thickened and some of them colored at the tips; hypothecium about half the height of the thecium and in color like the epithecium; asci inflated-clavate and ventricose,  $80\ \mu$  high,  $24\ \mu$  thick, the upper part of membrane thickened; spores broadly fusiform, bilocular, colorless, acuminate at both ends, 20 to  $24\ \mu$  long, 7 to  $9\ \mu$  thick; hymenial gelatine with iodine blue, soon sordid brownish yellow.

Among mosses on rocks or on the ground, in the Santa Monica and San Gabriel Ranges. Europe.

2. *Polychidium muscicola* (Swartz) S. F. Gray.

Thallus fruticulose, terete, shining, dark brown and blackening toward the apices, ramifying dichotomously and trichotomously, intertangled, 3 to 4 mm. high, a transverse section giving a cortical layer of large, oblong-ovoid cells, 10 to  $12\ \mu$  long, 6 to  $8\ \mu$  thick; under this layer the gonidial layer of blue green algæ, these 7 to  $10\ \mu$  in diameter, in the axis coarse longitudinal hyphæ; spermogones not seen; apothecia comparatively large, adnate, 0.25 to 1 mm. in diameter; disk concave, brown, the margin of the same color, erect, entire; epithecium light yellowish brown, subcontinuous; thecium colorless to pallid yellowish, 100 to  $108\ \mu$  high; paraphyses adglutinated; hypothecium colored similarly with the epithecium and about equaling the thecium in height; asci inflated-clavate or saccate; spores 6 to 8 in asci, oblong-fusiform, bilocular, a large oil globule in each loculus, acute or acuminate-blunt at each end, 24 to  $30\ \mu$  long, 7 to  $8\ \mu$  thick; hymenial gelatine with iodine blue except the epithecium, this retaining its natural color.

On sandstone, Topanga Canyon, Santa Monica Range.



## COLLEMACEAE.

Thallus gelatinous, crustaceous-foliaceous, squamulose or minutely fruticulose, homoömerous, with blue green Nostoc algæ; apothecia immersed in the thallus, close-fruited or open-fruited, or adnate-sessile, mostly lecanorine, rarely biatorine, with or without a proper parathecium and hypothecium (excipulum); disk punctiform or expanded; asci 8-spored; spores colorless, globular or acicular, simple, bilocular to several-locular or muriform.

In our species, apothecia lecanorine, spores bilocular to muriform.

## KEY TO GENERA.

- Thallus ecorticate..... COLLEMA (p. 71).  
 Thallus corticate on one or both surfaces ..... LEPTOGIUM (p. 73).

## COLLEMA (Hiller) Weber.

Thallus foliaceous, macrophylline to microphylline, sometimes almost crustaceous, gelatinous when moist; apothecia circular, innate to adnate-sessile, lecanorine; proper exciple present or wanting.

## KEY TO SPECIES.

Lobes of thallus large, rugulose.

Beset with granulations..... 2. *C. aggregatum*.

Not beset with granulations.

Apothecia dull reddish, naked..... 1. *C. nigrescens*.

Apothecia bluish pruinose..... 3. *C. glaucophthalmum*.

Lobes small.

Growing on a mineral substratum.

On rock.

Lobes turgid..... 7. *C. pulposum*.

Lobes not turgid..... 6. *C. cheileum*.

On earth.

Lobes thin, appressed..... 8. *C. limosum*.

Lobes suberect, clavate..... 5. *C. coccophorum*.

Growing on bark.

Lobes erect, fasciculate.

Spores fusiform..... 4. *C. fasciculare*.

Spores rounded-quadrangular..... 9. *C. verruciforme*.

1. *Collema nigrescens* (Leers) Wain.

Thallus foliaceous, black green, round-lobed, flattened, closely adherent, radiate-rugulose, lacunose beneath; apothecia sessile or elevated, 0.5 to 0.75 mm. in diameter; disk flat, red brown with a thin thalline margin, this finally obscured; epithecium subcontinuous, brown, thin; thecium colorless, 80 to 96  $\mu$  high; paraphyses coherent, strict; hypothecium pallid amber yellow; asci clavate, nearly equaling the thecium in height; spores fusiform, 6 to 8-locular, 60 to 68  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine with iodine blue; spermatia short, straight, 4 to 7  $\mu$  long, 1 to 1.5  $\mu$  thick.

On various barks in the Santa Monica Range and on slate rocks, on which substratum it is generally sterile.

2. *Collema aggregatum* (Ach.) Nyl.

Thallus black green, foliaceous, orbicular, 2 to 4 cm. in diameter, round-lobed, entire or with short marginal ciliæ, the upper surface irregularly rugose and beset with granulations, closely adherent except toward the ascending margins, somewhat paler beneath, lacunose and fenestrate; apothecia elevated-sessile; disk flat, at first delicately pruinose, later naked, reddish to almost concolorous with the thallus, the



thalline margin persistent and entire or also beset with fine thalline granulations; epithecium subgranulose, pale sordid yellowish; thecium 100 to 120  $\mu$  high, colorless; paraphyses adglutinated; hypothecium sordid yellowish, lighter than the epithecium, 20 to 25  $\mu$  high; asci subinflated-clavate; spores fusiform, 6-locular, 36 to 60  $\mu$  long, 5  $\mu$  thick.

On rocks, Santa Monica Range.

### 3. *Collema glaucophthalmum* Nyl.

Thallus black green, closely adhering except the ascendant, entire margins, undulate, deeply round-lobed, the upper surface rugulose and tuberculate, beneath lacunose and somewhat paler; apothecia generally numerous, sessile to elevated, 0.25 to 0.75 mm. wide; disk flat, soon convex and the at first thin regular margin disappearing, the pruina giving a purplish or whitish bloom to the disk; epithecium subcontinuous, yellowish brown; thecium 84 to 92  $\mu$  high, colorless to pale amber; paraphyses adglutinated, strict, hardly thickened at apices; hypothecium amber color, about 40  $\mu$  high; spores long fusiform, plurilocular, 40 to 56  $\mu$  long, 4 to 5  $\mu$  thick; septa faint but more numerous than in the last preceding species; asci clavate, nearly as high as the thecium; hymenial gelatine blue with iodine.

On bark of oaks in canyons of the Santa Monica and San Gabriel Ranges.

### 4. *Collema fasciculare* Ach.

Thallus blackish green, forming small orbicular cushions 2 to 3 cm. in diameter, composed of erect, clavate or dilate-fan-shaped fascicles 1 to 1.25 mm. high; apothecia numerous, sessile, one to several on the upper border of the lobule; disk primarily flat, then strongly convex, dull reddish, when moist of a light brick red, the thalline margin entire or crenulate; epithecium continuous, reddish brown, gradually paling downward; thecium 60  $\mu$  high, colorless, toward the circumference pale reddish; paraphyses adglutinate, slightly clavate at the colorless tips; asci clavate; hypothecium pallid, about equaling the thecium in height; spores 8, fusiform, mostly 4-locular, with globules in the cells, 18 to 26  $\mu$  long, 6 to 7  $\mu$  thick, outlines of the spores inclined to be unsymmetrical; hymenial gelatine with iodine blue.

On barks, Santa Monica Range.

### 5. *Collema coccophorum* Tuck.

Thallus black, forming patches 2 to 3.5 cm. wide, composed of small, aggregated, clavate lobules, 1.5 to 2 mm. high, coalescing toward the periphery in thin flat lobes 2 to 3 mm. wide with entire border, the upper surface beset with stout granules, the pedicellate lobules and flat lobes adhering to the substrate by a few slender rhizinae; apothecia subsessile or innate; disk reddish black, at first concave, then flat, the thalline margin crenate; epithecium continuous, dark reddish brown; thecium 68 to 100  $\mu$  high, colorless; paraphyses coherent; hypothecium colorless or pale amber; asci clavate, 60  $\mu$  long, 15  $\mu$  thick; spores 8, ovoid-ellipsoid, bilocular, slightly constricted, one end acuminate, 20  $\mu$  to 24  $\mu$  long, 7 to 9  $\mu$  thick, the loculi with oil globules; with iodine the asci stained blue, the paraphyses yellow, the hypothecium not changed.

On earth near Murietta Hot Springs; at Palm Springs and Topanga Canyon of the Santa Monica Range.

### 6. *Collema cheileum* Ach.

Thallus greenish black, foliaceous, lobes small, loosely imbricated, about 1 mm. wide, round, entire, undulate-plicate, and toward the base of lobule warty; apothecia innate, one in a lobule; disk reddish, flat with an at first erect thalline margin, entire or crenulate, or with minute round lobules; epithecium subentire, handsome dark brown; thecium 136 to 152  $\mu$  high, colorless; paraphyses loosely coherent, simple, entire, not thickened nor colored at the tips; hypothecium very faintly colored,



about two-thirds the height of the thecium; asci saccate, 126 to 130  $\mu$  high, thickened at top; spores 8, oblong ovoid ellipsoid, 4-locular and submuriform, 24 to 32  $\mu$  long, 16 to 20  $\mu$  thick; hymenial gelatine with iodine a handsome blue extending into the hypothecium, the spores pale yellow.

Frequent on sandstone in the Santa Monica Range.

The form *monocarpum* Nyl. occurs in the same locality, though less frequent; the thalline lobes are dispersed, small, and almost entirely covered by the solitary apothecium.

**7. *Collema pulposum* (Bernh.) Ach.**

Thallus hard, brittle when dry, when moist leathery and gelatinous, blackish green, orbicular, the prostrate lobes of the periphery becoming ascending toward the center, the lobes turgid, more or less deeply crenate at the margin and plicate; apothecia quite numerous, subinnate or appressed, 1 to 2 mm. in width; disk brick red, flat or convex, the thalline margin persistent, thick, crenulate; epithecium pale yellowish, gradually paling downward, subcontinuous; thecium 92 to 108  $\mu$  high, colorless; paraphyses adglutinate; hypothecium yellowish, darker than the epithecium; asci inflated-clavate; spores ovoid-ellipsoid, submuriform, 16 to 32  $\mu$  long, 8 to 16  $\mu$  thick, 4 or 5-locular, the central loculi again septate in the long axis of the spore.

In the Santa Monica Range on earth among mosses and on decaying granite.

**8. *Collema limosum* Ach.**

Thallus dark olive green, appressed or excentrally ascendent, the small lobes entire or crenulate, mostly approximate, hardly 0.5 cm. wide; apothecia appressed, flat to planoconvex, from 1 to 2.75 mm. in diameter, brick red and darkening, the thalline margin thick, entire or crenulate; epithecium subcontinuous, rich yellow, thicker and darker toward the circumference; thecium colorless, 100  $\mu$  high; paraphyses coherent; hypothecium about half the height of the thecium, of similar color and likewise darkening at the circumference; asci ventricose, equaling the thecium in height; spores obovoid-ellipsoid, 4-locular and submuriform, 22 to 30  $\mu$  long, 9 to 12  $\mu$  thick; hymenial gelatine blue with iodine, the spores yellow.

On earth in the Santa Monica Range. Southern United States; Europe; Asia (China).

**9. *Collema verruciforme* (Ach.) Nyl.**

Thallus dark brown, forming small patches of ascending clusters of broadly club-shaped, and toward the tops flattened and lobulate, lobules, about 2 to 3 mm. high; apothecia numerous, sometimes 3 or 4 on a lobule, sessile, 0.2 to 0.5 mm. in diameter; disk at first concave, then flat, dark red, when moistened of a bright blood red with a lighter colored, entire proper margin; epithecium continuous, chocolate brown; thecium 112 to 118  $\mu$  high, colorless; asci clavate to inflated-clavate, 64 to 80  $\mu$  long, 24 to 32  $\mu$  thick, the membrane thickened above; spores 4-locular, 16 to 22  $\mu$  long, 12  $\mu$  thick, quadrangular in shape with rounded angles, the loculi with oil globules; hymenial gelatine with iodine blue, the spores pale straw color; spermatia minute, oblong, 3 to 4  $\mu$  long, barely 1  $\mu$  thick.

On decayed oak wood in the Yosemite Valley. It may extend to our territory.

**LEPTOGIUM (Ach.) S. F. Gray.**

Thallus membranaceous, crustaceous-granulose and lobed at the periphery, foliaceous or fruticulose, the upper or both surfaces pseudoparenchymatous-corticate; gonidia moniliform, consisting of Nostoc; apothecia innate to sessile, lecanorine, the disk circular, the margin containing gonidia; asci 8-spored, the spores colorless, fusiform, 4 to several-locular and to muriform; spermatia small, ovoid or cylindric, straight.



## KEY TO SPECIES.

- Substratum bark; lobes ascending, foliaceous, the upper surface  
 beset with lobules..... 2. *L. burgessii*.  
 Substratum rock and earth.  
 Thallus crustaceous-granulose..... 7. *L. rhyparodes*.  
 Not crustaceous.  
 Lobulate.  
 Lobes club-shaped..... 1. *L. plicatile*.  
 Lobes not club-shaped.  
 Foliaceous.  
 Minute..... 5. *L. tenuissimum*.  
 Larger.  
 Palmately lobed..... 6. *L. palmatum*.  
 Not palmately lobed.  
 Laciniate-lobed..... 3. *L. californicum*.  
 Deeply lacero-laciniate..... 4. *L. lacerum*.

**1. *Leptogium plicatile* (Ach.) Nyl.**

Thallus small, orbicular, cartilaginous, deeply lobed, the narrow central lobes ascending; apothecia sessile at the apices of the crowded lobes; disk dull brownish, remaining long concave, the proper margin entire, thick, somewhat lighter colored; epithecium amber color, gradually paling downward; thecium colorless, about 140  $\mu$  high; paraphyses adglutinated; hypothecium dull yellow brown, darker than the epithecium; asci oblong-cylindric, about equaling the thecium in height; spores ovoid-ellipsoid, submuriform, 4-locular with several longitudinal septations of the loculi, 16 to 32  $\mu$  long, 8 to 14  $\mu$  thick; hymenial gelatine deep blue with iodine.

Thallus with a small-celled pseudoparenchymatous cortex, and the medullary hyphae narrow.

On calcareous tufa in the Santa Monica Range.

**2. *Leptogium burgessii* (Lightf.) Mont.**

Thallus forming purplish brown cushions from 1 to 2 cm. wide, foliaceous and lobed, the lobes imbricated, rounded and sinuate, the upper surface closely beset with erect, oblong lobules, the lower intricately rugulose, pale; apothecia minute, 1 to 1.5 mm. wide, surrounded by a laciniate thalline margin; disk concave, with an entire proper margin, both concolorous with the thallus; thecium 140 to 180  $\mu$  high; asci oblong-cylindric, 120  $\mu$  long, 16 to 18  $\mu$  thick; spores ellipsoid, apiculate at each end, muriform, 32  $\mu$  long, 16  $\mu$  thick.

On bark. Collected in Lower California by T. S. Brandege and deposited in the Herbarium of the California Academy of Sciences at San Francisco. Previous to the destruction of that herbarium by the catastrophe of April 18, 1906, the writer, through the kindness of the curator, Miss Alice Eastwood, was given the opportunity of examining the lichens of the Academy, and from a fragment retained by permission this description is taken. The species may be found in our district.

**3. *Leptogium californicum* Tuck.**

Thallus dark brown, sinuate, laciniate-lobed, the lobes from 1 to 1.5 cm. in length, short and imbricated in the center, the lobules more coarsely lacerated than in *L. palmatum*, the upper and lower surfaces finely reticulate-wrinkled; apothecia sessile, small, 0.2 to 0.75 mm. wide, the disk convex and with the entire margin concolorous with the thallus; epithecium colorless; thecium colorless, about 140  $\mu$  high; paraphyses septate, simple, entire, clavate at the tips; hypothecium colorless, thin; spores 6-locular, ellipsoid and submuriform, 24 to 44  $\mu$  long, 7 to 13  $\mu$  thick.

Among moss on rocks, near Mayfield, *Herre*; Santa Monica and San Gabriel Ranges and doubtless throughout the State.



Two forms are recognized: Forma *platynum* of authors, with irregular and larger lobes (up to 4 cm. long), finely wrinkled and tuberculate, the color, in the herbarium, quite leaden gray, the spores 40 by 16  $\mu$ —on earth above Saratoga, California, *Herre*; and forma *lophatum* of authors, the lobes finely and deeply dissected, the thallus dark chestnut brown and glistening, the tips of the laciniae granular-thickened—forming dense cushions among moss, Mount Wilson of the San Gabriel Range, at 1,650 meters; Yosemite Valley at a like elevation.

**4. *Lepotogium lacerum* (Retz) S. F. Gray.**

Thallus foliaceous, brown, becoming grayish brown in the herbarium, the lobes densely intricate, deeply and narrowly lacero-laciniate, forming cushions; apothecia elevated-sessile, about 0.75 mm. in diameter; disk concave, with the entire, smooth margin light reddish; epithecium subgranulose, yellowish greenish brown; thecium about 140  $\mu$  high, colorless; paraphyses strict, slender, loosely coherent; hypothecium almost colorless; asci cylindric, about equaling the thecium in height; spores oblong-ellipsoid, one end long-attenuate, muriform, 28 to 44  $\mu$  long, 10 to 16  $\mu$  thick; hymenial gelatine with iodine deep blue, the spores yellow.

On the ground running over moss; Mill Creek Canyon, San Bernardino Range at 1,700 meters. Throughout North America; South America (Chile); Europe.

**5. *Leptogium tenuissimum* (J. E. Smith) Koerb.**

Thallus minute, brown, of laciniate, small, foliaceous squamules; apothecia sessile, from 0.2 to 0.75 mm. in diameter; disk at first immersed, urceolate, with a turgid margin, to finally flat, dull reddish, the margin thinner and lighter colored than the disk; spores oblong-ellipsoid, 5-locular with several of the loculi subdivided in the longitudinal axis, 32 to 36  $\mu$  long, 12 to 16  $\mu$  thick.

On sandstone, Santa Monica Range; Santa Cruz Mountains at 1,700 meters altitude, *Herre*.

**6. *Leptogium palmatum* (Huds.) Mont.**

Thallus dark brown, becoming grayish brown, palmate-lobate, the lobes irregularly lacerate and convolute, appearing corniculate; apothecia small, 0.25 to 0.33 mm. in diameter, appressed; disk concave, brick red, the entire margin paler; epithecium continuous, pale brownish yellow; thecium 180  $\mu$  high, colorless; paraphyses not thickened above, distinct; hypothecium colorless; asci clavate, about 150  $\mu$  high, spores broadly ellipsoid and ovoid-ellipsoid, 4-locular and submuriform, 18 to 36  $\mu$  long, 12 to 20  $\mu$  thick.

On earth among moss; Santa Cruz Peninsula, *Herre*; at Santa Barbara; Santa Monica Range. Pacific Coast States. Europe.

**7. *Leptogium rhyarodes* Nyl.**

Thallus thin, coarsely and unequally granulate-crustaceous, brown to darkening; apothecia small, at first concave, the disk dull brick red, the elevated, entire margin of lighter color, later flat and biatorine; epithecium pallid, granulose; thecium about 140  $\mu$  high, colorless; paraphyses slender, loosely adglutinated; hypothecium pale yellowish; asci inflated-clavate; spores ellipsoid and fusiform-ellipsoid, 28 to 32  $\mu$  long, 12 to 14  $\mu$  thick, 6 or 7-locular and submuriform; hymenial gelatine with iodine faint blue, the asci darker, especially at the apices.

On sandstone and earth among moss, in the Santa Monica Range.

## HEPPIACEAE.

Thallus squamulous-crustaceous, of dark brownish olive green color, closely attached to the substratum by rhizinae; squamules generally monophyllous, (thallus approaching a fruticulose form with us only in *Heppia zahlbruckneri*.) the loosely pseudoparenchymatous structure inclosing Scytonema gonidia—moderately large, pale bluish green



algal cells, mostly several grouped together; apothecia immersed or the disk at times slightly elevated; proper exciple ill developed and a thalline margin often wanting; paraphyses slender, jointed, unbranched; asci paucisporous or multisporous; spores colorless, globular or ovoid; spermatia ellipsoid to oblong, short.

### HEPPIA Naeg.

The only genus. Characters of the family.

#### KEY TO SPECIES.

**Thallus monophyllous or nearly so.**

Strictly monophyllous.

Border irregularly lobate-crenate..... 6. *H. hassei*.

Border entire.

Raised more or less.

Border thin..... 1. *H. bolanderi*.

Border thick, grayish granulose..... 2. *H. guepini*.

Border not raised.

Disk large, solitary..... 3. *H. terrena*.

Disk quite small, solitary..... 5. *H. leptopholis*.

**Thallus submonophyllous.**

Disk large, one to several in squamule..... 4. *H. despreuxii*.

Disk minute, immersed..... 8. *H. polyspora*.

**Thallus not monophyllous.**

Polyphyllous sterile..... 7. *H. conchiloba*.

Subfruticulose..... 9. *H. zahlbruckneri*.

#### 1. *Heppia bolanderi* (Tuck.) Wain.

Squamules dark umber brown, dispersed or crowded and imbricated, orbicular or sinuate and undulating, from 0.5 to 4 mm. in width, centrally loosely attached to the substrate; apothecia imbedded in the thallus, indicated by a minute orifice; spores minute and numerous.

Quite frequent on sand rock in the Santa Monica Range

#### 2. *Heppia guepini* (Delise) Nyl.

Squamules monophyllous, stout, 1.5 to 4 mm. wide, the upper surface brownish olive green, undulate or planoconvex, the border turgid, repand, grayish-granulose, sinuate, entire or interrupted, beneath light brown, centrally affixed to the substrate; apothecia imbedded and rarely seen; asci broadly oblong-ellipsoid; spores minute and numerous.

On various rocks; frequent throughout our district. Eastern and Middle United States; Europe; Australia.

#### 3. *Heppia terrena* Nyl.; Hasse, Bull. Torrey Club 24 : 445. 1897.

The mostly dispersed squamules roundish, dark olive green, from 0.75 to 1.5 mm. in width, flattish, the border lightly curved upward, attached to the substrate by thick hyphæ; apothecia one in a squamule, when mature occupying, except a narrow rim, nearly the entire surface of squamules, adnate and slightly projecting above the surrounding thallus; disk circular, flat, red brown when dry, brighter red when moistened, 0.5 to 0.75 mm. in diameter, a thin thalline wall inclosing the thalamium cup-like on the sides and beneath, the thin hypothecium resting almost directly upon the substrate; epithecium subentire, yellow; thecium 140 to 160  $\mu$  high, colorless; paraphyses slender, compact, not thickened nor colored at the tips; hypothecium almost colorless, 60  $\mu$  high; asci 120  $\mu$  long, 32  $\mu$  thick, the wall thick, especially the hoodlike top inclosing the attenuate apex of the cavity; spores regularly globular, numerous, 4 to 4.5  $\mu$  thick; hymenial gelatine with iodine blue, with KHO a handsome purple, except the hypothecium, the epithecium becoming dark brownish purple; spermatogones not seen.



On earth. Type locality, on the western slope of the San Gabriel Range, along the "New Mount Wilson Trail" at 650 meters altitude; Verdugo Mountains above Casa Verdugo; Topanga Canyon, Santa Monica Range at 850 meters.

Type deposited with Doctor Nylander; duplicates with Dr. A. Zahlbruckner and Prof. Bruce Fink, and in herb. Hasse.<sup>1</sup>

**4. *Heppia despreauxii* (Mont.) Tuck.**

Thallus of pale olive green squamules, these small, orbicular, or attaining a width even of 6 to 7 mm., the larger deeply incised and lobed, attached by the entire lower surface to the substrate; apothecia innate, from one in the smaller to a dozen in the larger squamæ; disk depressed, flat, circular, dull brown when dry, brick red when moistened; thecium 130 to 140  $\mu$  high, colorless or pallid yellow in places; epithecium subcontinuous, yellowish; paraphyses loosely coherent, the tips not colored nor thickened; hypothecium pale yellowish, almost colorless; asci saccate, about equaling the thecium; spores 8, large, oblong-ellipsoid, 16 to 22  $\mu$  long, 8 to 10  $\mu$  thick, the exospore thin; hymenial gelatine with iodine sordid blue, no change with KHO.

On earth, widely dispersed; San Bernardino, *Parish*; Santa Monica Range. Throughout the United States; Europe.

**5. *Heppia leptopholis* Nyl.; Hasse, Lich. South. Calif. 10. 1898.**

Squamules mostly orbicular, coarsely pseudoparenchymatous throughout, 1 to 2 mm. wide, concave or flat, yellowish olive green, above finely reticulated and fissured, the entire under surface attached to the substrate by loose hyphæ; apothecia innate, not exceeding 0.5 mm. in width, disk at first little more than punctiform, red, finally larger, round, papillate, flush with the thallus, a complete absence of a proper margin or parathecium; epithecium continuous, yellowish orange, the coloration occupying about one-fifth of the thecium, this otherwise colorless, 180 to 184  $\mu$  high; paraphyses loosely coherent, slender, the tips not colored nor thickened; hypothecium faintly yellowish tinged, almost colorless, of about the thickness of the thecium; asci nearly equaling the height of the paraphyses, upper half of the membrane thickened, the cavity gradually attenuate upward, wine bottle shaped; spores small, regularly globular, 5 to 6  $\mu$  in diameter; with iodine the asci staining blue, especially above, the rest of the hymenial structure yellow, the epithecium dark orange.

"Affinis *Heppiae psammophilae*," Nylander.

On earth. Type locality, foothills of Santa Monica Range near the Soldiers' Home. Also on Santa Catalina Island.

Type deposited with Doctor Nylander; duplicates in the herbarium of the New York Botanical Garden, the U. S. National Herbarium, and herb. Hasse.

**6. *Heppia hassei* Zahlbr. Beih. Bot. Centralbl. 13: 157. 1902.**

Squamules appressed, about 1 mm. in diameter, orbicular, lobate-crenate to irregularly round, mostly approximate, slightly ascending at the margin, homoömerous, pseudoparenchymatous-cellular, the *Scytonema* gonidia glomerulose-concatenate; apothecia solitary in squamules, immersed; disk red brown, flat, primarily punctiform, then dilated to about 1 mm. wide, papillate-roughened; thalline margin thin; hypothecium narrow, yellowish; exciple thin; thecium pale roseate, 120 to 127  $\mu$  high, with iodine vinous red; asci numerous, ventricose-saccate, 100 to 120  $\mu$  long, 22 to 27  $\mu$  thick, the membrane above calyptriform, thickened; epithecium reddish; paraphyses embedded in hymenial gelatine; spores numerous, oval, decolorate, simple, 5 to 7  $\mu$  long, 3.5 to 4  $\mu$  thick, the epispore thin.

On granite. Type locality, Palm Springs at the eastern base of the San Jacinto Range.

Type deposited with Dr. A. Zahlbruckner and in herb. Hasse.

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<sup>1</sup> Prof. B. Fink, Lichens of Minnesota, Contr. U. S. Nat. Herb. 14: 150. 1910, believes this species to be identical with *Heppia despreauxii*. However, aside from the general coarseness of the latter and its one squamule often containing several apothecia, the difference in the spores suffices to establish the authenticity of Nylander's *H. terrena*.



**7. *Heppia conchiloba* Zahlbr. Beih. Bot. Centralbl. 13: 157. 1902.**

The writer is without a specimen; therefore the original description of Dr. A. Zahlbruckner is given:

"Thallus substrato parte centrali innatus, foliaceus, 6-15 mm. in diam., radiatolobatus, lobis conchiformibus, auriculatim confertis, marginibus granuloso-scabridis, siccus coriaceo-cartilagineus, cervino-murinus, opacus, madefactus prasino-virescens, usque 0.3-0.5 mm. crassus, superficie punctulato-granulosus, subtus undique hyphis hypothallinis creberrimis, thallo longioribus, ramosis et intricatis, 9-10  $\mu$  crassis, leptodermaticis, septatis (cellulis 17-20  $\mu$  longis) vestitus; superne pseudoparenchymaticus, gonidiis destitutus, pseudocellulis rotundato-angulosis, sat magnis, 10-13  $\mu$  longis, membrana modice crassa, in seriebus 3-5 horizontalibus dispositis; stratum medullare totum gonidia continens; ex hyphis verticalibus, leptodermaticis, ramosis, 5-5.5  $\mu$  crassis, septatisque (cellulis usque 17  $\mu$  longis) formatum; gonidia *Scytonemea*, glaucescenti-virentia, cellulis magnis, 8-12  $\mu$  in diameter, glomeruloso-concatenatis. Apothecia et pycnoconidia non visa.

"Ad terram agillaceo-sabulosam, Palm Springs, in lateribus orientalibus montium San Jacinto."

**8. *Heppia polyspora* Tuck.**

Thallus of dark olive green squamules, round, entire or lobulate, 2 mm. and less in width, flattened-convex and diminishing in thickness toward the periphery, brownish beneath, attached by central hyphæ to the substrate; squamules containing from a few to 8 apothecia with punctiform, depressed disks; epithecium colorless in the center, becoming brown at the circumference, subcontinuous; thecium 100 to 116  $\mu$  high, colorless in the center and pale brownish outward; paraphyses loosely adglutinate, the tips not thickened nor colored; hypothecium pale yellowish; asci subcylindric, nearly equaling the thecium in height; spores numerous, globular small 2 to 4  $\mu$  in diameter; hymenial gelatine with iodine blue.

On sandstone, Santa Monica Range; on granite, Elsinore, Riverside County.

**9. *Heppia zahlbruckneri* Hasse, Bryologist 14: 100. 1911.**

Thallus of short, erect, terete to subterete lobules, 1 to 2 mm. thick and 3 to 3.5 mm. high, aggregated into groups and loosely attached to the substratum by medullary hyphæ; tops clavate to bulbous, often dilating and assuming a flattened apex; of olive green color or darkening; pseudoparenchymatous cortex, containing the gonidial layer, 40  $\mu$  thick, the pale green *Scytonema* gonidia 6 to 12  $\mu$  in diameter; medullary layer composed of loosely interwoven hyphæ, notably at the axis, from 2 to 3  $\mu$  thick; apothecia 1 to 8 in a lobule head, immersed, marked by a punctiform perforation of the cortex, this sometimes slightly dilated to not exceeding 0.25 mm. in width and depressed; disk dull brown, the flesh-colored, flattened-globular hymenium beneath the gonidial layer; thecium 140  $\mu$  high, colorless; paraphyses loosely coherent, slender; hypothecium colorless or of a pallid yellowish tint; asci quite numerous, the upper part slightly attenuate, the membrane about 3  $\mu$  thick throughout, 112  $\mu$  long, 28 to 32  $\mu$  thick, the immature asci shorter with solid tops, spores globular, 4.5 to 7  $\mu$  in diameter (the liberated spores giving the larger dimension), 24 to 32 being contained in the ascus; hymenial gelatin with iodine a pale indigo blue, changing to sordid pale greenish; KHO giving a bronze red color to the gonidial layer; spermatia not seen.

On quartz in Rubio Canyon, San Gabriel Range, near Pasadena, the type locality. Collected by Mr. C. C. Kingman. It has since been sent from Riverside by Mr. F. M. Reed, and collected by the author at Eden Hot Springs, Riverside County found also (rarely) in the Santa Monica Range.

The species differs from others with similar spore measurements in the shape of the thalline lobules.

Type deposited with Doctor Zahlbruckner; duplicate in herb. Hasse.



## PANNARIACEAE.

Thallus from semicrustaceous to squamulose and subfoliaceous, corticate above, beneath with or without a cortex; medullary layer mostly well developed, containing *Nostoc*, *Scytonema*, or rarely *Pleurococcus* gonidia; hypothallus and rhizinae distinct; apothecia circular, lecanorine or biatorine; paraphyses not branched; asci with 8 colorless, simple, rarely parallel, 3 to 5-locular spores, their membrane thin and destitute of a gelatinous halo; sterigma articulate; spermatia short, straight.

Thallus in ours with blue green *Nostoc* or *Scytonema* gonidia; cortex of upper surface distinct.

## KEY TO GENERA.

## Apothecia lecanorine.

Thallus with *Nostoc* gonidia..... PANNARIA (p. 81).

Thallus with *Scytonema* gonidia..... MASSALONGIA (p. 81).

## Apothecia biatorine or lecideine.

Spores simple..... PARMELIELLA (p. 79).

Spores parallel 2 or more locular..... PLACYNTHIUM (p. 80).

## PARMELIELLA Muell. Arg.

Thallus squamulose, lobed at the periphery or almost foliaceous, attached to the substrate by a distinct hypothallus or by rhizinae; gonidia *Nostoc*; apothecia biatorine, the excipulum without gonidia; asci 8-spored, spores colorless, simple, oblong to ellipsoid.

## KEY TO SPECIES.

Thallus lobed, the lobes linear and cleft..... 4. *P. sonomensis*.

Thallus not lobed, squamulose.

Squamules not imbricated; apothecia rare, minute..... 1. *P. ruderatula*.

Squamules imbricated more or less closely.

Yellowish gray ..... 2. *P. microphylla*.

Greenish gray to brownish ..... 3. *P. lepidota*.

1. *Parmeliella ruderatula* (Nyl.).

*Pannularia ruderatula* Nyl.; Hasse, Lich. South. Calif. 10. 1898.

Thallus of minute, cervine brown, squamulose scales, these from 0.5 to 1 mm. wide and about 0.25 mm. thick, when dry concave and the border connivent, when moistened flat, imbricated, the border minutely crenulate-globular; section of squamule showing above a layer of flattened, hyaline cells, 4 to 6  $\mu$  thick, resting upon a double or triple layer of rounded-quadrangular cells, 10 to 12  $\mu$  thick, beneath this the gonidial layer of blue green *Nostoc* cells, 4 to 8  $\mu$  thick, and below the medullary layer of smaller colorless cells 6 to 8  $\mu$  thick; hypothallus formed of similar dingy brownish cells; apothecia biatorine, sessile, 1 mm. wide and almost entirely covering the squamule, the disk flat, dark purple brown with an entire, lighter colored margin; epithecium subcontinuous, light yellowish brown, gradually paling downward; thecium 112 to 120  $\mu$  high, the lower two-thirds colorless; paraphyses stout, 2 to 3  $\mu$  thick, faintly septate, the slightly clavate tips light brown, some forking above; hypothecium pale straw color; asci inflated-clavate; spores 8, oblong-ellipsoid, 19 to 21  $\mu$  long, 6 to 6.5  $\mu$  thick; hymenial gelatine blue with iodine; spermatia oblong, 6 to 8  $\mu$  long, 0.75  $\mu$  thick, sterigma straight.

On earth. Type locality, foothills of Santa Monica Range above the Soldiers' Home.

Type deposited with Doctor Nylander; duplicates with Prof. Bruce Fink, in the U. S. National Herbarium, and in herb. Hasse.



**2. *Parmeliella microphylla* (Swartz) Muell. Arg.**

Thallus of light yellowish gray, imbricated, crenate-dentate and lobulate squamules 1 to 2 mm. wide; apothecia biatorine, sessile, from 0.25 to 1 mm. wide; disk flat, light brick to reddish-colored with a paler margin, at last convex; epithecium continuous, pale straw color; thecium 112  $\mu$  high, colorless or faint yellowish tinted especially the lower part; paraphyses septate, not well defined, loosely coherent, some forked below the tops, clavate above; hypothecium straw color; asci clavate; spores oblong-ellipsoid, simple, colorless, 14 to 20  $\mu$  long, 5 to 8  $\mu$  thick; hymenial gelatine blue with iodine.

On earth and in earth-covered crevices of rocks, Santa Monica Range. Eastern and southern United States; South America (Chile) and Europe.

The forma *californica* of Tuckerman differs only in the larger size of the spores, the largest being 24 by 9  $\mu$ . It is found in the Santa Monica and San Gabriel ranges (Rubio Canyon).

**3. *Parmeliella lepidiota* (Sommerf.) Herre, Proc. Washington Acad. Sci. 12: 150. 1910.**

*Lecidea carnosa lepidiota* Sommerf. Suppl. Fl. Lapp. 174. 1826.

Thallus squamulose, light grayish greenish to chocolate color; squamules about 2 mm. wide, closely imbricated, crenate and lobulate, light gray at the border, beneath whitish, the hypothallus indistinct; apothecia often crowded, sessile, biatorine, 0.5 to 1.5 mm. wide, the disk dull brick red, from flat with a distinct lighter colored margin becoming convex and immarginate; epithecium continuous, pale yellowish brown, 80 to 116  $\mu$  high; paraphyses coherent, stout, septate, slightly clavate at apices; asci cylindric or clavate, extending to the epithecium; spores 8, colorless, ellipsoid, simple, 18 to 20  $\mu$  long, 7 to 9  $\mu$  thick; hymenial gelatine stained blue with iodine except a narrow rim of epithecium, this retaining its natural color, no change with KHO; thallus pseudoparenchymatous throughout, the gonidia Nostoc.

On earth and in crevices of earth-covered rocks. Santa Cruz Mountains, Herre; Santa Monica Range. Western and northern North America, England, and Scotland.

The variety *coralliphora* of authors has the squamules changed to a dense coralloid mass, the fruiting as in the species. It occurs from the Santa Cruz Peninsula, Herre, south to the Santa Monica Range.

The variety *cyanolepra* of authors has the thallus composed of coarse blue gray granules, the apothecia unknown. It has the same range with the species.

**4. *Parmeliella sonomensis* (Tuck.).**

*Pannaria sonomensis* Tuck. Syn. N. Amer. Lich. 1: 126. 1882.

Thallus brownish olive green, of discrete, linear, parted lobes upon a black hypothallus; apothecia minute, lecanorine, sessile, the disk dark; spores fusiform, simple, curved, 20 to 30  $\mu$  long, 3  $\mu$  thick.

On granite, Yosemite Valley; on trap, Topanga Canyon in Santa Monica Range at 270 meters altitude.

**PLACYNTHIUM (Ach.) Harm.**

Thallus crustaceous-areolate, coralline to microsquamulose; hypothallus blue black or obsolete; apothecia sessile, lecideine or biatorine; paraphyses thick, not branched, septate and darkened at the tips; asci clavate, 8-spored; spores oblong to ovoid-ellipsoid, parallel 3 to 9-locular.

**KEY TO SPECIES.**

- Apothecia black; thallus coralloid-squamulose..... 1. *P. nigrum*.  
 Apothecia purplish black; thallus microphylline..... 2. *P. microphyllizum*.



**1. *Placynthium nigrum* (Huds.) S. F. Gray.**

Thallus minutely coralloid-squamulose, brownish, dark olive greenish to dull black, continuous, coralloid when moist, interrupted or diffract when dry; apothecia subinnate, from 0.5 to 1.25 mm. wide; disk black, smooth, biatorine, flat to at last lightly convex; epithecium bluish gray to blue, subgranulose; thecium 60 to 80  $\mu$  high, colorless; paraphyses separate, stout, clavate at the bluish tips with one or two septa below; hypothecium from colorless to fuscescent; asci inflated-clavate, about 20  $\mu$  shorter than the paraphyses; spores 8, colorless, oblong with blunted ends, bilocular to quadrilocular, 16 to 20  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine with iodine blue; gonidia (*Scytonema*) blue green, 8 to 16  $\mu$  in diameter.

On shaded, earth-covered boulders; frequent in the Santa Monica Range. Southern and middle western United States into Canada; England; continental Europe; New Zealand.

**2. *Placynthium microphyllizum* (Nyl.).**

*Pannularia microphylliza* Nyl.; Hasse, Lich. South. Calif. 9. 1898.

Thallus squamulose, light chocolate to cervine brown; squamules small, 1 to 1.5 mm. wide, contiguous, convex with an ascending, crenulate-lobulate border, pale beneath; apothecia sessile, biatorine, 0.5 to 0.75 mm. in diameter; disk dusky red brown, flat, the paler margin at last obscure and the disk lightly convex; epithecium subcontinuous, sordid brownish yellow; thecium 80 to 128  $\mu$  high, colorless; paraphyses loosely coherent, slightly thickened above; hypothecium yellowish, paler than the epithecium; asci inflated-clavate, 56 to 60  $\mu$  high, 18  $\mu$  thick, 8-spored; spores elongate-ellipsoid, 16 to 28  $\mu$  long, 6 to 9  $\mu$  thick, 2 to 4-locular; iodine staining all the hymenial structures deep blue.

Type locality, along the "Old Wilson Trail," San Gabriel Range on quartz and in the Santa Monica Range on sandstone.

Type deposited with Dr. W. Nylander; duplicates with Prof. C. E. Clements, Prof. Clara Cummings, Mr. W. W. Calkins, Dr. J. W. Eckfeldt, in the U. S. National Herbarium, and in herb. Hasse.

**PANNARIA Delise.**

Thallus granulose, squamulose to foliaceous with a blue black or black hypothallus and *Nostoc* gonidia; apothecia primarily innate, at last sessile to lecanorine; hypothecium pallid; spores simple, oblong-ellipsoid and fusiform.

A single species with us.

**1. *Pannaria pezizoides* (Weber) Lightf.**

Thallus minutely squamulose, dusky greenish brown, the squamules densely imbricated, about 1 mm. wide, coarsely crenate at the border, pale beneath; apothecia subinnate, 1 to 1.5 mm. wide; disk brick red and duller red, soon convex with a persistent, prominent, coarsely crenate thalline margin; epithecium pale yellow; thecium colorless, 100  $\mu$  high; paraphyses coherent; hypothecium equaling the epithecium in color; asci elongate-clavate, spores 8, simple, colorless, oblong-ellipsoid with two oil globules and pointed at one or both ends, 20 to 30  $\mu$  long, 8 to 12  $\mu$  thick, sometimes lightly curved; hymenial gelatine with iodine light blue.

On earth near Glenivvy, Riverside County; Topanga Canyon, Santa Monica Range; Matilija Canyon, Ventura County; Yosemite Valley. Ranges throughout northern North America; Europe.

**MASSALONGIA Koerb.**

Thallus microphylline-squamulose, corticate above, ecorticate beneath, the layer of *Scytonema* gonidia situated below the upper cortex, medullary layer loose; apothecia biatorine, marginal; disk flat; hypothecium pallid, imposed upon a gonidial layer; asci 8-spored, the spores fusiform, colorless, bilocular; sterigma jointed, spermatia short, straight.

A single species within our limits.



1. *Massalongia carnosa* (Dicks.) Koerb.

Thallus squamulose, dark brown; squamules lobate, incised, suberect and imbricated, about 2 mm. wide, pale beneath; apothecia small, barely over 0.5 mm. wide, sessile; disk flat, biatorine, dark brown when dry, moistened dark red; epithecium continuous, reddish brown; hypothecium faintly yellowish tinted; thecium 100  $\mu$  high, colorless; paraphyses coherent, septate, some capitate and colored at the top; asci inflated-clavate; spores oblong-ellipsoid, bilocular, 22 to 24  $\mu$  long, 8 to 11  $\mu$  thick, the epispore thin; hymenial gelatine blue with iodine, soon becoming brown.

Among moss on boulders. Yosemite Valley. Arctic Canada; England.

### STICTACEAE.

Thallus frondose-foliaceous, large, horizontally spreading, loosely attached to the substratum, both surfaces corticate; beneath the upper cortex the gonidial layer of *Palmella* or *Nostoc* gonidia; under surface with tomentose rhizinae and cyphels—circular, depressed perforations of the cortex, or pseudocyphels—roundish, white isidiose spots; apothecia sessile or elevated, scutelliform with a proper margin; paraphyses stout, septate, not branching; spores colorless or colored, fusiform to acicular and bilocular to plurilocular; sterigma multiarticulate; spermatia short, straight, mostly with slightly thickened ends:

Only one genus and one species as yet reported from our district.

### STICTA (Schreb.) Ach.

Characters of the family.

1. *Sticta anthraspis* Ach.

Thallus large, spreading, 5 to 15 cm. wide, tawny brown, deeply lobed, the rounded lobes crenate-lobulate at the border, the upper surface reticulate, deeply and coarsely lacunose, the under surface fawn-colored at the circumference, darkening centrally where affixed to the substratum, and clothed throughout with a dense short nap; white pseudocyphellae numerous; apothecia sessile along the prominent reticulations, from 1 to 4 mm. in diameter; disk reddish brown, at first concave with a crenulate thalline margin, eventually flattish and the margin obscure; epithecium continuous, brown; thecium 84 to 96  $\mu$  high, colorless or pale brownish in places; paraphyses coherent, gently clavate at the pale brown tips, septate; hypothecium yellow; asci clavate and inflated-clavate; spores fusiform, from mostly bilocular to 4-locular, 22 to 32  $\mu$  long, 5 to 8  $\mu$  thick, epispore thick.

Along the Pacific coast; Westport, Washington, *Foster*; Santa Cruz Peninsula, *Herre*; on oak bark at 800 meters altitude in the San Gabriel Range along the "New Mount Wilson Trail."

### PELTIGERACEAE.

Thallus frondose-foliaceous, mostly large, the upper surface corticate, beneath this the gonidial layer composed of *Palmella* and *Nostoc* gonidia; lower surface reticulate-veiny and villous, ecorticate, affixed to the substratum by bundles of rhizinae issuing from the veins; apothecia mostly marginal, roundish, sessile or innate upon the upper or under surface of the thallus; asci 2-sporous to multisporeous; spores colorless, light or dark brown, ellipsoid, fusiform to acicular, bilocular to parallel-plurilocular. The family is represented in southern California by one genus.

### PELTIGERA Willd.

Thallus frondose, large, corticate only above, beneath villous and reticulate-veiny; apothecia adnate-sessile on the upper surface of extended lobes, without a true thalline margin; asci 6 to 8-spored; spores colorless, fusiform, parallel 4 to 8-locular, the epispore thin. Gonidial layer beneath the cortex, of blue green *Nostoc* or bright yellow green gonidia.



## KEY TO SPECIES.

Lobes small.

Veins with fibrils.

Veins thick, pale..... 3. *P. rufescens*.

Veins not thick, obscure..... 2. *P. scutata*.

Fibrils almost wanting..... 4. *P. spuria*.

Lobes large.

Smooth above..... 1. *P. canina*.

Sorediate above, especially at the border..... 1a. *P. canina sorediata*.

**1. *Peltigera canina* (L.) Hoffm.**

Thallus foliaceous, large, horizontally spreading, lobes rounded, entire to sinuate, crenate at the border, greenish or brownish, upper surface downy with clustered, stellate, short hairs, beneath whitish with light brown veins and fibrils; apothecia marginal on upper surface, round, brown red; disk flat with a finely crenate spurious margin; epithecium pallid, subcontinuous; thecium colorless or with a tint of yellow, 100 to 108  $\mu$  high; paraphyses coherent, strict, septate, slightly clavate and colored at the tips; hypothecium small-celled, pale yellowish; asci narrow clavate; spores fusiform, 5-locular, 56 to 68  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine deep blue, except the unchanged epithecium.

On earth and rocks among mosses. San Bernardino Mountains, *Parish*; San Gabriel and Santa Monica ranges; Yosemite Valley. Throughout North America; mountains of tropical and South America; Europe.

**1a. *Peltigera canina sorediata* (Schaer.) Fink, Bull. Lab. Nat. Hist. Univ. Iowa 3: 76. 1895.**

*Peltigera canina spuria sorediata* Schaer. Enum. Lich. Eur. 21. 1850.

Smaller, brown above, not villous, the border turned up, crimped and gray sorediate, beneath darker than in the species; no fruiting specimens seen. On earth among moss in the San Gabriel Range.

**2. *Peltigera scutata* (Dicks.) Leight.**

Thallus small, smooth above, dusky brown, the lobules rounded, small with entire border, beneath paler brown than above, the fibrils short and stout and the veins not prominent, often of the same color as the under surface; apothecia on scarcely elongated lobules, short and broad, the disk dull blackish brown; spores acicular, 30 to 70  $\mu$  long, 4 to 5  $\mu$  thick, 5 to 8-locular.

On earth, Lytle Creek, San Bernardino Mountains, *Parish*.

**3. *Peltigera rufescens* (Neck.) Hoffm.**

Thallus middling large, light brown (in herbarium), slightly downy and roughened above, paler beneath with thick, pale veins, the lobes rounded, less deeply incised than in *P. canina*, the border crenulate; apothecia on elongated lobules, oblong with a nearly entire margin, the disk dark red brown; spores acicular, 42 to 60  $\mu$  long, 3 to 5  $\mu$  thick, 4 to 8-locular.

On earth near San Bernardino, *Parish*. Throughout North America; Europe; northern Africa; Hawaiian Islands.

**4. *Peltigera spuria* (Ach.) Lam. & DC.**

Lobes small, less than 1 cm. wide and 1.5 to 2 cm. long, light brown and obscurely villous above, ascending, with slightly crenulate border, beneath of lighter color, scarcely villous the veins concolorous and almost destitute of fibrils; apothecia at end of lobule, broader than long, with revolute, thin, crenulate margin; disk flat, dark brown black; epithecium continuous, reddish brown, gradually paling downward; thecium 120  $\mu$  high, colorless below; paraphyses strict, coherent, dimly septate, slightly clavate and faintly colored at the tips; hypothecium pale reddish brown; asci narrowly clavate, the membrane thickened at top, 86 to 100  $\mu$  long, 14  $\mu$  thick;



spores fusiform, acicular,  $68\ \mu$  long,  $4\ \mu$  thick, 5 or 6-locular; with iodine the asci staining blue, the rest of the hymenial structures orange red.

On earth; San Bernardino Mountains, *Parish*; Matilija Canyon, Ventura County; Yosemite Valley. Northern Atlantic Coast; Europe; Tasmania; New Zealand.

### PERTUSARIACEAE.

The genus *Pertusaria* is the sole representative of this family with us.

#### PERTUSARIA Lam. & DC.

Thallus crustaceous, uniform, intimately affixed to the substratum by medullary or hypothalline hyphæ, the gonidial layer, covering the medullary, composed of *Cystococcus* gonidia (synonyms *Pleurococcus*, *Protococcus*); apothecia either lecanoroid with a thalline margin, or the hymenia immersed in thalline verrucæ, one to several in each, the disk then contracted, punctiform or seen as a mere depression of the thalline wart; paraphyses branching, slender; asci containing 1 to 8 spores, these simple, colorless, generally very large, the epispore thick; spermogones immersed in the verrucæ; spermatia cylindric to acicular.

#### KEY TO SPECIES.

Growing on rock.

Thallus sulphur-colored, rimose..... 2. *P. flavicunda*.

Thallus whitish gray, smooth..... 3. *P. nolens*.

Growing on bark.

Thallus whitish to light gray.

Disk pruinose, flesh-colored..... 1. *P. lecanina*.

Disk not pruinose, dark, small..... 6. *P. leioplaca*.

Thallus dark ash gray.

Disk dilated, round, black..... 4. *P. wulfenii*.

Disk punctiform, stellate or irregular-shaped..... 5. *P. pustulata*.

#### 1. *Pertusaria lecanina* Tuck.

Thallus smooth, becoming slightly rugulose, creamy yellow, with a dark hypothalline border; apothecia sessile, from 0.5 to 1.25 mm. in width; disk with a thalline margin, primarily flat, thickly pruinose, at last slightly depressed and pale rose color, KHO staining the thalline margin of the mature apothecia orange, then red, the thallus faint yellowish; this stain of the thalline margin appearing on the species only when growing upon *Juglans californica*; epithecium colorless; thecium colorless; paraphyses free, slender, forked; hypothecium colorless; asci thick-walled, 2-spored; spores 112 to 140  $\mu$  long, 40 to 48  $\mu$  thick, the epispore very thick; hymenial gelatine with iodine a deep blue.

On the smooth barks of the wild walnut, and of *Quercus agrifolia*; less common on other barks. Frequent in the Santa Monica Range. According to Tuckerman it occurs in small patches accompanying *Pertusaria leioplaca* and *P. communis*; in Southern California the patches are often large and without the association of these two species.

#### 2. *Pertusaria flavicunda* Tuck.

Thallus sulphur-colored, rimose-areolate, the areoles angular, granular or minutely verruculose, diminishing in size toward the circumference or becoming indistinctly radiate; hypothallus pallid, KHO+yellow, Ca(ClO)<sub>2</sub>+orange; apothecia sessile, verrucose; disk flat, somewhat impressed, dark dusky yellowish pruinose, round or angular, in places the apothecia supplanted by isidiose glomerules; spores 2 or 3, ovoid-ellipsoid, 80 to 84  $\mu$  long, 46 to 52  $\mu$  thick, the epispore very thick; hymenial gelatine deep blue with iodine, the spores yellow.

On rocks and siliceous pebbles at San Diego; at Del Mar; calcareous rocks near Santa Monica; Santa Catalina Island. Appears to favor localities not distant from the ocean.



**3. *Pertusaria nolens* Nyl.**

Thallus thin, smooth, leaden gray or dull ash gray, finely rimose-areolate, KHO—,  $\text{Ca}(\text{ClO})_2$ —, with determinate outline and a pale hypothallus; apothecia 1 or 2 to an areole, immersed, minutely crateriform or mostly irregular in shape and from the fissured thalline margin appearing stellate; disk dark; thecium colorless; paraphyses slender, branched and interwoven; asci cylindric-oblong, 120 to 140  $\mu$  long, 32 to 36  $\mu$  thick, 8-spored; spores ellipsoid, 32 to 42  $\mu$  long, 14 to 22  $\mu$  thick, acuminate-pointed at the ends, the endospore smooth or barely wrinkled; hymenial gelatine with iodine yellow and only the asci blue.

On schistose rocks in the Santa Monica Range (Sepulveda and Rustic canyons). Externally it is similar to and easily confounded with *Lecanora laevata* Nyl.

**4. *Pertusaria wulfenii* Lam. & DC.**

Thallus ash gray, rugose-verrucose and rimose, neither KHO nor  $\text{Ca}(\text{ClO})_2$  giving a reaction; apothecia in elevated, flattened verrucæ; disk blackish, now and then dilated, depressed, with a turgid thalline margin formed by the verrucæ; epithecium grayish yellow, after KHO pale yellow; thecium 240  $\mu$  high; hypothecium colorless; asci ventricose, containing 8 irregularly disposed spores, these ovoid-ellipsoid, 48 to 60  $\mu$  long, 24 to 32  $\mu$  thick, the epispore and ascus membranes thinner than in other species; hymenial gelatine with iodine blue, the spores yellow.

On various barks, Tehachapi Mountains; San Bernardino Mountains at "Seven Oaks"; Santa Catalina Island.

**5. *Pertusaria pustulata* (Ach.) Nyl.**

Thallus light gray with a faint yellow dash, areolate-rimose, one or several semiglobular verrucæ to an areole, KHO+faint yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia one or more in a wart; disk small, irregularly substellate or merely a punctiform slight depression; epithecium subgranulose, dark yellowish gray; thecium 80  $\mu$  high; hypothecium similar to the epithecium in color; asci tubular or cylindric, iodine staining them a deep blue; spores in 2's, 80 to 136  $\mu$  long, 22 to 48  $\mu$  thick.

On various barks; frequent in the Santa Monica Range.

**6. *Pertusaria leioplaca* (Ach.) Schaer.**

Thallus light yellowish gray, smooth becoming fissured, KHO+yellow then pale violet,  $\text{Ca}(\text{ClO})_2$ —; apothecia in sessile, semiglobular, elevated verrucæ, mostly single, sometimes 2 or 3 to a wart, slightly flattened, the disk small, almost punctiform, dark, indistinct; paraphyses slender, branching; thecium colorless; spores ellipsoid, 44 to 96  $\mu$  long, 24 to 64  $\mu$  thick, from 4 to 8 in an ascus seen in the same section of an apothecium; hymenial gelatine deep blue with iodine, the liberated spores yellow.

On various barks. From Washington, *Foster*; Santa Cruz Mountains, *Herre*; Santa Monica Range. From southern Canada to Texas; Europe; southern Africa; South America.

**LECANORACEAE.**

Thallus crustaceous, uniform or lobed at the periphery, exceptionally fruticulose, without rhizinae, affixed to the substratum by medullary or hypothalline hyphae, with or without a cortex; apothecia permanently innate or sessile, with a thalline margin; hypothecium pallid; paraphyses either not branching and separate or branching and interwoven; asci 8 to 32-spored, the spores colorless, simple or parallel-bilocular to plurilocular, or muriform-multilocular; spermatia variously shaped.

**KEY TO GENERA.**

Spores simple.

Crescent-shaped..... *HARPIDIUM* (p. 86).

Globular, ellipsoid, or oblong.

Paraphyses branching, interwoven; spores large.... *OCHROLECHIA* (p. 95).

Paraphyses not branching; spores not large..... *LECANORA* (p. 86).



Spores compound.

Bilocular.

Thallus gray or brown..... LECANIA (p. 95).

Thallus not gray or brown.

Yellow; disk bright-colored..... CANDELARIELLA (p. 99).

Not yellow; disk blackish to black..... PLACOLECANIA (p. 98).

Muriform-multilocular ..... PHLYCTIS (p. 98).

### HARPIDIUM Koerb.

Thallus crustaceous, uniform, areolate; apothecia subinnate, circular, with a thalline margin, a proper margin not apparent; hypothecium pallid; paraphyses not branching, septate; asci 8-spored, the spores colorless, simple, crescent-shaped, the epispore thin; spermogones immersed; sterigma simple, straight; spermatia short, oblong-ellipsoid.

Within our limits only one species.

#### 1. *Harpidium glaucophanum* Nyl.

*Lecanora glaucophana* Nyl.; Hasse, Lich. South. Calif. 11. 1898.

Thallus of dispersed, white, lobulate and lobed squamules, 2 to 4.5 mm. in width, dark beneath, affixed centrally to the substrate, KHO+yellow, Ca(ClO)<sub>2</sub>—; apothecia innate, 1 or 2 in a squamule, 0.5 to 1.5 mm. wide; disk flat, papillate, level with or barely protruding above the thalline surface, reddish brown, becoming black in the herbarium; epithecium subcontinuous, rich reddish brown; thecium colorless, 60  $\mu$  high, with iodine blue, the color of the epithecium unchanged; paraphyses adglutinate; hypothecium of a faint yellowish tint; asci inflated-clavate; spores simple, broadly fusiform crescent shaped, rarely several straight, 11 to 16  $\mu$  long, 3 to 4  $\mu$  thick.

On gneiss and other crystalline rocks. Type locality at Camp Baldy, San Antonio Canyon in the San Gabriel Range, at 1,600 meters altitude.

Type deposited with Dr. W. Nylander; duplicates with W. W. Calkins, in the herbarium of the New York Botanical Garden, and in herb. Hasse.

### LECANORA Ach.

Thallus crustaceous, uniform, lobed at the periphery or squamulose, rarely fruticulose; gonidia *Protococcus algæ* (*Cystococcus* Naeg.); apothecia permanently innate or sessile, bordered by a thalline margin; parathecium (proper exciple) mostly not well developed; paraphyses not branching; hypothecium pallid or colored; spores normally 8, rarely in multiples of the normal, 16 or 32, colorless, ellipsoid or oblong to globular, straight or bean-shaped, thin-walled; spermatia staff-shaped to acicular, straight or curved.

#### KEY TO SECTIONS.

Apothecia permanently immersed; spores large; thallus crustaceous, uniform .....

1. ASPICILIA.

Apothecia sessile.

Thallus crustaceous, uniformly areolate to warty .....

2. EULECANORA.

Thallus crustaceous to squamulate in the center and lobed

more or less at the periphery ..... 3. PLACODIUM.



## KEY TO SPECIES.

Section 1. **ASPICILIA** T. Fries.

- Substratum earth; thallus dull greenish gray, lobate at border.. 5. *L. glaucopsina*.  
 Substratum rock.  
 Thallus disappearing..... 6. *L. praecrenata*.  
 Thallus present, some shade of gray.  
 Disk pruinose..... 1. *L. calcarea*.  
 Disk not pruinose, black.  
 Thallus gray, more or less warty.  
 With KHO no reaction..... 3. *L. gibbosa*.  
 With KHO+red..... 2. *L. cinerea*.  
 Thallus not warty, smoothish..... 4. *L. laevata*.

Section 2. **EULECANORA** Wain.

- Substratum rock.  
 Thallus obsolete; disk brownish..... 17. *L. polytropa*.  
 Thallus present.  
 Apothecia small; disk grayish to brownish..... 10. *L. hageni*.  
 Apothecia larger.  
 Disk naked, black.  
 Apothecia internally black..... 7. *L. atra*.  
 Apothecia internally pale..... 12. *L. coilocarpa*.  
 Disk with some kind of covering.  
 Disk with a bloom, dull yellowish to light  
 brown..... 14. *L. cenisia*.  
 Disk densely pruinose.  
 Pruinose throughout..... 11. *L. sordida*.  
 Not pruinose throughout, the proper mar-  
 gin black..... 11a. *L. sordida bi-*  
*cincta*.  
 Substratum bark (rarely rock).  
 Thallus absent or disappearing.  
 Disk grayish flesh-colored to dull black..... 18a. *L. symmicta sae-*  
*pincola*.  
 Disk buff to pale brown, biatorine..... 16a. *L. varia illu-*  
*soria*.  
 Thallus present.  
 Brown, the disk dark..... 19. *L. phaeobola*.  
 Of some color other than brown.  
 Thallus white to grayish.  
 Apothecia large.  
 Disk black, naked, internally pale..... 12. *L. coilocarpa*.  
 Disk brown..... 8. *L. subfusca*.  
 Apothecia small.  
 Disk naked.  
 Dark brown..... 13. *L. allophana*.  
 Pale brown..... 8a. *L. subfusca dis-*  
*tans*.  
 Disk not naked.  
 Disk with a delicate bloom.  
 Buff color and darkening..... 9. *L. pacifica*.  
 Light grayish..... 10. *L. hageni*.  
 Disk coarsely pruinose..... 15. *L. albella*.  
 Thallus pale greenish yellow.  
 Disk pale buff with a bloom..... 16. *L. varia*.  
 Disk rusty brown, biatorine..... 18. *L. symmicta*.



Section 3. **PLACODIUM** (Hiller) T. Fries.

Thallus peltately affixed.

Disk reddish buff..... 21. *L. rubina*.

Disk black.

Thallus greenish yellow..... 21a. *L. rubina opaca*.

Thallus white..... 22. *L. marginalis*.

Thallus not peltately affixed.

Closely affixed to substratum.

Sulphur-colored, furfuraceous..... 23. *L. pinguis*.

Greenish yellow to darkening..... 20. *L. saxicola*.

Thallus not closely affixed, dull greenish brown, the periph-

eral lobes white-margined..... 24. *L. melanaspis  
alphoplaca*.

**1. Lecanora calcarea** (L.) Nyl.

Thallus crustaceous, white, mealy, rimose-areolate, determinate or subdeterminate; hypothallus pale, KHO—, Ca(ClO)<sub>2</sub>—; medulla not stained with iodine; apothecia immersed, almost punctiform but becoming larger; disk concave, dark but appearing white from a dense pruina, round or angular; epithecium sordid grayish yellow, subgranulose; thecium 216  $\mu$  high, colorless; paraphyses subcoherent, moderately coarse, finely granular, septate, the septa quite close, especially in upper part (visible after KHO); hypothallus colorless; asci ventricose; spores 6 to 8, arranged in one or two files, ovoid and subglobular, 16 to 28  $\mu$  long, 15 to 20  $\mu$  thick; hymenial gelatine stained indigo blue with iodine, turning brownish reddish.

The thallus is often grayish in color, but reactions and measurements are the same.

On calcareous and other rocks. Mountains of Ventura County (Matilija Canyon), frequent in the Santa Monica Range. The thallus varies and the following forms occur:

The forma *hoffmanni* Sommerf., with the thallus of contiguous or discrete verruciform squamules, flattish at the circumference and rising crateriform toward the middle of the squamule, gray, sordid greenish gray, also pale testaceous, the disk not seldom black, naked—is found in the Santa Cruz Mountains, *Herre*, and at Daggett, Mohave Desert, *Parish*. The forma *monstrosa* Cromb. occurs occasionally on sandstone in the Santa Monica Mountains—the verrucæ white, mealy, discrete and scattered, convex with small, immersed, pruinose concave disk, without spores.

**2. Lecanora cinerea** (L.) Sommerf.

Thallus crustaceous, thick, whitish to light gray, rimose-areolate, the areoles angular, flat or slightly concave, smoothish, KHO+ yellow then rusty red, the medulla unchanged with iodine; apothecia immersed, small to minute, from 0.5 to 2 mm. wide; disk at first flat, sometimes finally slightly convex, dull black, the larger moderately umbilicated and sometimes with a thin grayish bloom, bounded by a persistent thalline margin; epithecium forming a thin dark line, subcontinuous; thecium colorless, about 180  $\mu$  high; paraphyses loose, coherent at the tips, septate, as seen after KHO; hypothecium pallid, a fourth of the height of the thecium; asci ventricose, 6 to 8-spored, the spores ovoid, with granular contents, 24 to 28  $\mu$  long, 16 to 20  $\mu$  thick; spermatia straight, acicular, 24 to 32  $\mu$  long; sterigma simple, straight; hymenial gelatine with iodine blue, turning greenish blue.

On granite, Mount Wilson at 1,700 meters; San Antonio Canyon at 1,500 meters; in the San Bernardino Mountains, *Parish*.

**3. Lecanora gibbosa** (Ach.) Nyl.

Thallus thick, gray, rimose-areolate, the areolæ rugulose, warty, KHO—, Ca(ClO)<sub>2</sub>—; hypothallus pallid; apothecia primarily immersed-sessile; disk flat, black, naked, round or by crowding of apothecia irregular, now and then becoming convex, surrounded by a slightly elevated thalline margin; epithecium subcontin-



uous, yellowish gray to smoky brown; thecium 100 to 128  $\mu$  high, colorless; paraphyses coherent; hypothecium colorless or faint yellowish tinted; asci ventricose; spores ovoid, 15 to 32  $\mu$  long, 12 to 20  $\mu$  thick, epispore thick; hymenial gelatine blue with iodine, soon changing to brown.

On various rocks, Santa Cruz Peninsula, *Herre*; Santa Monica Mountains; Tehachapi Mountains at 1,300 meters; San Gabriel Mountains. Canada and the northern United States; Europe; Asia; Japan.

**4. *Lecanora laevata* (Ach.) Nyl.**

Thallus thin, smoothish, delicately rimose-areolate, the areolae angular, sordid grayish, flat or slightly concave; hypothalline border dull black or bluish black, KHO—, Ca(ClO)<sub>2</sub>—; apothecia small, punctiform to 0.5 mm. wide, immersed; disk concave, black, the thalline margin not or slightly elevated; epithecium pale dingy yellowish brown, subcontinuous; thecium colorless, 132 to 136  $\mu$  high; paraphyses slender, loose, coherent at the apices; hypothecium colorless; spores ovoid, 24 to 28  $\mu$  long, 16  $\mu$  thick; hymenial gelatine dull blue with iodine.

On siliceous pebbles in the Santa Monica Range and at Del Mar; on granite, San Antonio Canyon in the San Gabriel Mountains. Eastern United States; northern Asia; Europe.

**5. *Lecanora glaucopsina* Nyl.; Hasse, Lich. South. Calif. 12. 1898.**

Thallus crustaceous, squamulose, pale grayish greenish, subdeterminate; squamules rugulose, contiguous, and subimbricate, angular or with wavy outline, becoming lobulate at the border, loosely attached to the substratum, KHO—, Ca(ClO)<sub>2</sub>—; apothecia innate or subinnate, often crowded, 0.25 to 0.8 mm. wide; disk flat, black, round or oblong, or by juxtaposition irregularly roundish, when moistened brick red as with a moistened *Heppia*, with a bluish black proper margin and an erect, persistent, entire or subcrenulate thalline margin; epithecium continuous, light brownish; thecium colorless, 140  $\mu$  high; paraphyses septate, the tips slightly or not at all clavate nor colored; hypothecium colorless; asci ventricose or subventricose, with 6 to 8 spores, these ovoid, 18 to 22  $\mu$  long, 11 to 14  $\mu$  thick; hymenial gelatine with iodine blue; spermatia acicular, straight, 20 to 22  $\mu$  long and less than 1  $\mu$  thick.

On clay. Type locality, "Barton's Peak," Santa Monica Range.

Type deposited with Dr. W. Nylander; duplicates with Dr. A. Zahlbruckner and in herb. Hasse.

**6. *Lecanora praecrenata* Nyl.; Hasse, Lich. South. Calif. 12. 1898.**

Thallus diffuse, dirty whitish, indeterminate, or absent; apothecia sessile, circular; disk flat, dusky brown with a white, regularly crenulate thalline margin, the crenules globular, uniform in size, necklace-like surrounding the disk, this margin persistent and slightly elevated; spores 4 to 6, globular, 20  $\mu$  in diameter with finely granular contents and thin epispore; hymenial gelatine with iodine blue turning yellowish green, the spores yellow from the first.

On decomposed granite. Type locality in the Santa Monica Range at "Barton's Peak."

Type deposited with Dr. W. Nylander; duplicate in herb. Hasse.

**7. *Lecanora atra* (Huds.) Ach.**

The crustaceous thallus white, of more or less contiguous verrucæ, with a black hypothalline border, KHO+yellow; apothecia sessile, from 1 to 3 mm. wide; disk black, soon convex, often glistening, with a persistent, entire or coarsely crenulate (Santa Catalina Island) thalline margin; epithecium continuous, bluish black, gradually paling downward and in places staining the thecium to near its base; thecium 68  $\mu$  high; paraphyses coherent; asci clavate, 8-spored, spores broadly ellipsoid, 12 to 13  $\mu$  long, 8.5  $\mu$  thick; hymenial gelatine with iodine blue; epithecium covered by a hyaline, continuous membrane, 2 to 4  $\mu$  thick, sharply defined from the dark



epithecium; with KHO the epithecium turning violet purple. On section the entire hymenium appears black to the unaided eye, this distinguishing it from externally similar lichens.

On various rocks. San Diego, *Cleveland*; Del Mar; Santa Catalina Island; Topanga Canyon in the Santa Monica Range. Throughout the United States, and from the Arctic Regions to Mexico. Europe; Africa; western Asia.

**8. *Lecanora subfusca* (L.) Ach.**

Thallus whitish to light ash color, coarsely granulate, verruculose or also becoming rimose-areolate, generally determinate, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia numerous, crowded or scattered, sessile, from 0.5 to 1.25 mm. wide; disk from plane soon convex, rusty brown, with an entire, permanent thalline margin; epithecium light sordid reddish brown, continuous or subcontinuous; thecium colorless or faintly tinged by the fading color of the epithecium, 60 to 80  $\mu$  high; paraphyses strict, compacted, scarcely thickened at the colorless or barely tinged tips; hypothecium colorless; asci clavate; spores 8, ellipsoid, 12 to 18  $\mu$  long, 7 to 10  $\mu$  thick; hymenial gelatine blue with iodine.

On various barks; common. San Bernardino, *Parish*, and throughout our district.

The species is quite variable and a number of forms are described. The variety *campestris* Nyl. has the thallus rougher, dirty white, the disk brown and darker to dusky black. On rocks, frequent. In the variety *argentata* Ach. the thallus is thin, smooth, white, the apothecia dark brown, smaller than in the species, the thalline margin entire. On bark and dead wood, Santa Catalina Island, *Baker*; Santa Cruz Peninsula, *Herre*; Santa Monica Range.

**8a. *Lecanora subfusca distans* (Ach.) Nyl.**

Thallus thin, smooth to finely granulate, determinate, ashy gray with a thin, black hypothalline border, or indistinct on rough barks, KHO+greenish yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.5 to 1.25 mm. wide; disk flat to lightly convex, pale grayish buff with a faint bloom, and with a thin, permanent, finely crenulate thalline margin, becoming flexuose from crowding; epithecium subgranulose, dingy pale yellowish white; thecium 80 to 112  $\mu$  high, colorless; paraphyses coherent; hypothecium colorless; spores oblong-ellipsoid, 15 to 18  $\mu$  long, 8 to 10  $\mu$  thick, with one or two oil globules; hymenial gelatine with iodine blue, particularly upper part of thecium and asci a dull reddish purple, turning sordid brown.

On various smooth barks. Santa Monica and San Gabriel Ranges; at Del Mar.

**9. *Lecanora pacifica* Tuck.**

Thallus whitish, continuous, granulose-verrucose, the hypothallus black; with KHO thallus and thalline margin staining yellow, the disk not affected by  $\text{Ca}(\text{ClO})_2$ ; apothecia sessile, 0.5 to 2.25 mm. wide; disk flat, pale greenish or buff, in color not unlike *Lecanora varia*, or becoming grayish green to blackish, with a faint bloom; the whitish lecanorine margin elevated, thick, persistent, radiately incised-crenate; in general outward appearance the apothecia similar to those both of *Lecanora varia* and *L. pallida*, partaking of the form of the latter and the coloration (disk) of the former; epithecium continuous or finely granulose, sulphur color or light grayish brownish; thecium 72 to 80  $\mu$  high, colorless or sordid, of lighter shade than the epithecium; paraphyses slender, adglutinate; hypothecium similar to the thecium in color; asci subinflated-clavate, almost equaling the thecium in height; spores 8, ovoid-ellipsoid, 11 to 17  $\mu$  long, 6 to 9  $\mu$  thick; hymenial gelatine with iodine deep blue, the spores a pale straw color, KHO giving no reaction.

On barks near San Diego, *Orcutt*; on various barks in the Santa Monica range and doubtless throughout our district, but easily overlooked and mistaken for other *Lecanorae*.



**10. *Lecanora hageni* Ach.**

Thallus thin, verruculose, ash-colored, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia mostly numerous, sessile, not surpassing 1 mm. in width; disk flat, light brownish or grayish, pruinose; thalline margin thin, white, entire becoming crenulate and flexuose; epithecium colorless, subcontinuous; thecium  $56\ \mu$  high, colorless; paraphyses stout,  $2\ \mu$  thick, septate, the tips lightly clavate and colorless; hypothecium colorless, nearly equaling the thecium in height; asci subinflated-clavate, 44 to  $48\ \mu$  high; spores 8, ovoid-ellipsoid and ellipsoid, 9 to  $16\ \mu$  long, 4 to  $6\ \mu$  thick, variously disposed, longitudinal or transverse; reaction with iodine blue, then sordid reddish brown; spermatia bowed or semicircular.

Common throughout Southern California, on barks and rocks.

**11. *Lecanora sordida* (Pers.) T. Fries.**

Thallus determinate, whitish to ashy white, thick, rimose-areolate, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia innate to adnate-sessile, 0.5 to 2 mm. wide; disk flat and slightly convex, dull black and thickly pruinose; thalline margin turgid, persistent, often sinuate; epithecium gray and yellowish gray, subgranulose; thecium 80 to  $84\ \mu$  high, colorless or lightly yellowish tinged; paraphyses coherent, not thickened above; asci inflated-clavate; spores 8, ovoid-ellipsoid, 10 to  $13\ \mu$  long, 6 to  $8\ \mu$  thick, the epispore thick; hymenial gelatine deep blue with iodine, with KHO no change except in the epithecium, this rendered almost colorless.

On granite and other crystalline rocks; San Bruno Mountain at 350 meters altitude and Santa Cruz Mountains at 800 meters altitude, *Herre*; San Bernardino Mountains; San Gabriel Mountains at 1,500 meters altitude.

**11a. *Lecanora sordida bicincta* (Ramond) T. Fries.**

Apothecia becoming strongly convex and the disk densely pruinose, but the proper margin black, destitute of pruina.

Tehachapi Mountains at 1,600 meters near "Lone Pine Mine."

**12. *Lecanora coilocarpa* (Ach.) Nyl.**

Thallus whitish, thin, smooth becoming granulate, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.5 to 1.25 mm. wide; disk flat to convex, mostly black (internally pallid), occasionally with a faint bloom, with a thin, entire thalline margin; epithecium continuous, bluish black, after KHO fuliginous; thecium colorless, 64 to  $68\ \mu$  high; paraphyses stout, some forked near the tips and indistinctly septate, slightly clavate; asci cylindric, 52 to  $56\ \mu$  long; spores 8, ovoid-ellipsoid,  $16\ \mu$  long, 7 to  $9\ \mu$  thick; reaction with iodine blue. On various barks and sandstone.

Throughout southern California; San Bernardino, *Parish*.

**13. *Lecanora allophana* Nyl.**

Thallus subdeterminate, sordid white, verrucose, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, crowded, 0.3 to 1 mm. wide; disk black, flat to convex, thalline margin crenulate and flexuose; epithecium brown, continuous; thecium  $108\ \mu$  high, colorless; paraphyses strict, compacted, coarse, adglutinated at the brownish, clavate tips; hypothecium colorless; asci clavate, reaching into the colored epithecium; spores 8, ellipsoid, 14 to  $20\ \mu$  long, 7 to  $10\ \mu$  thick, the epispore thick; hymenial gelatine with iodine blue, the thecium darker blue and violet; gonidial layer underlying the hypothecium.

On sandstone, Santa Monica Range; on bark, Tehachapi Mountains.

**14. *Lecanora cenisia* Ach.**

Thallus coarsely globular-granulate, or verruculose-areolate, ash gray, subdeterminate or determinate and with a black hypothalline border, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia medium, sessile; disk at first flat, then convex, red brown;



thalline margin in the mature apothecia finely crenulate; epithecium continuous, reddish brown, gradually fading downward, the color disappearing after KHO; thecium colorless, 96 to 128  $\mu$  high; paraphyses strict, loosely coherent or well separated, some with clavate and pale colored tips, septate (after KHO); hypothecium pale yellowish; asci clavate; spores 8, ovoid-ellipsoid, 12 to 18  $\mu$  long, 6 to 11  $\mu$  thick; hymenial gelatine blue with iodine, soon reddish brown.

On rocks, sandstone boulders; San Bernardino Mountains, in Mill Creek Canyon, at 1,500 meters altitude.

**15. *Lecanora albella* (Pers.) Ach.**

Thallus cream color, becoming more yellow or dun color, smoothish, finely rimose, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.5 to 2 mm. wide, often crowded and from pressure difform; disk flat or undulating, flesh-colored and white-pruinose; thalline margin stout, entire to flexuous and even sinuate, persistent; epithecium granulose, pale grayish yellowish; thecium 80 to 100  $\mu$  high, colorless; paraphyses loosely adglutinated, septate after KHO; hypothecium colorless; asci inflated-clavate, 72 by 20  $\mu$ ; spores 8, ovoid, 12 to 18  $\mu$  long, 6 to 10  $\mu$  thick; hymenial gelatine deep blue with iodine.

Frequent on various barks; Santa Catalina Island, *Baker*; Santa Monica and San Gabriel Ranges; San Bernardino Mountains, *Parish*.

The variety *canceriformis* Tuck. has a rougher, verruciform thallus and difform apothecia with the thalline margin irregular, sinuate-lobate. It occurs with the species.

**16. *Lecanora varia* (Hoffm.) Ach.**

Thallus effuse, pale yellowish greenish to pale buff, thin, areolate-verrucose or granulose, KHO+yellow,  $\text{Ca}(\text{ClO}_2)$ —; apothecia numerous and often crowded, not exceeding 1 mm. in width, sessile; disk from flat to convex, yellowish greenish and buff with a delicate bloom, with a thin crenulate and flexuose thalline margin, later becoming obsolete; epithecium continuous, hyaline; thecium colorless, 56 to 60  $\mu$  high; paraphyses coherent; hypothecium with a very faint yellowish tinge; asci clavate, reaching the height of the thecium; spores 8, oblong-ellipsoid, 11 to 14  $\mu$  long, 5 to 6  $\mu$  thick; the entire hymenium blue with iodine, KHO—.

Frequent on various barks. Santa Cruz Peninsula, *Herre*; near San Bernardino, *Parish*; Santa Catalina Island.

**16a. *Lecanora varia illusoria* Ach.**

Thallus absent; apothecia sessile; disk buff to pale brown, flat to convex and biatorine.

Near San Bernardino, *Parish*. Determined by the late Doctor Stizenberger.

**17. *Lecanora polytropa* (Hoffm.) Schaer.**

Thallus obsolete; apothecia sessile, from 0.25 to 1 mm. wide, crowded or dispersed; disk flat to convex, reddish brown, the thalline margin very thin, becoming obsolete; epithecium subcontinuous, grayish yellow and yellowish brown; thecium 60 to 100  $\mu$  high, sordid pale yellowish or nearly colorless; paraphyses subcoherent, strict, not thickened at the apices; hypothecium of the same hue as the thecium; asci clavate; spores 8, bluntly ellipsoid, 9 to 13  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine with iodine dark sordid blue or violet blue.

On sandstone and conglomerate, Santa Monica Range and Ballona Bluffs.

**18. *Lecanora symmieta* Ach.**

Thallus thin, granulose or pulverulent, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ +orange (the last reaction faint on the specimens collected); apothecia sessile, numerous, small, none over 0.25 mm. wide; disk convex, light rusty brown; thalline margin obsolete (biatorine); epithecium subgranulose, colorless; thecium colorless; 44 to 48  $\mu$  high, paraphyses loosely coherent; hypothecium colorless; asci clavate; spores 8, ellipsoid,



8 to 11  $\mu$  long, 4 to 7  $\mu$  thick; hymenial gelatine with iodine blue, the hypothecium light blue, the final change of blue to "sordid yellow,"<sup>1</sup> not observed.

On dead wood near San Bernardino, *Parish* (determination of Doctor Stizenberger). On the same substrate near Los Gatos, *Herre*; on living bark of oak in the Santa Monica Range.

**18a. *Lecanora symmicta saepincola* (Ach.) Nyl.**

Thallus pulverulent, almost disappearing, the chemical reactions of the species not apparent; apothecia sessile; disk flat, grayish flesh-colored to dull blackish with a very thin, finely crenulate thalline margin; epithecium subcontinuous to continuous brown, paling toward the periphery; thecium 48 to 56  $\mu$  high, almost colorless, pale brown in the center; paraphyses coherent; hypothecium a little darker than the epithecium; asci clavate; spores ovoid-ellipsoid, 8 to 10  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine deep blue.

On dead pine limbs, Strawberry Valley, San Jacinto Mountains, at 1,300 meters; on decaying wood and dead oak bark in the Tehachapi Mountains at about the same altitude.

**19. *Lecanora phaeobola* Tuck.**

Thallus of small light brown to brown papillae, roundish or crenulate, KHO—, Ca(ClO)<sub>2</sub>—; apothecia closely sessile, small, 0.25 to 0.5 mm. wide; disk flat, dark brown to blackish with a thin concolorous margin, this finally obsolete; epithecium subcontinuous, grayish brown; thecium 64 to 68  $\mu$  high, colorless; paraphyses subcoherent, the tips clavate and light brown, some furcate under the apices; hypothecium pale brown; asci clavate; spores 8, oblong-ellipsoid, 10 to 18  $\mu$  long, 4 to 5  $\mu$  thick.

On dead *Pinus lambertiana* in the Sierra Nevada near Wauwona, at 1,400 meters altitude.

**20. *Lecanora saxicola* (Poll.) Ach.**

Thallus adpressed, pale greenish yellow, glaucous to yellowish brown (especially becoming so in the herbarium), forming round patches, rimose-areolate in the center, radiately spreading and lobed at the periphery, the contiguous lobes there flattened, dilated and crenate at the border; apothecia sessile, crowded at the center; disk flat, concolorous with the thallus, more yellowish; thalline margin persistent, entire to crenulate, regular or contorted; epithecium continuous, sordid pale yellowish; thecium 52 to 72  $\mu$  high, colorless; paraphyses strict, capillary, subcoherent, septate, the apices not or but slightly thickened; hypothecium sordid pale yellowish; asci inflated-clavate, equaling the thecium in height; spores 8, oblong-ellipsoid, 11 to 16  $\mu$  long, 6 to 7  $\mu$  thick; hymenial gelatine blue with iodine; sterigma simple, straight; spermatia acicular, arcuate.

Common on various rocks, from the lowlands ascending the higher mountains. San Bernardino Mountains, *Parish*; near Riverside, *Reed*; frequent in the Santa Monica Range.

The species varies somewhat and the following forms are found: The variety *diffracta* Fries has the thallus darker, light yellowish brown, the areoles more diffract and black margined. At Mount Wilson, San Gabriel Range. The variety *semitensis* Tuck. with the thallus reduced to smaller, scattered, dusky yellowish squamules may yet be found in the higher mountains of our territory. The variety *versicolor* Fries has the thallus pale, white pruinose and depressed at the periphery, the thalline margin white pulverulent. At lower elevations. Topanga Canyon of the Santa Monica Range at 280 meters.

**21. *Lecanora rubina* (Lam. & DC.) Ach.**

Thallus subfoliaceous, pale, yellowish green, spreading at the periphery by short, turgid, rounded, crenate lobes, beneath leather color, blackening toward the circum-

<sup>1</sup> Cromb. Monogr. Brit. Lich. 433. 1894.



ference, affixed centrally by a short pedicel; apothecia sessile and adnate-sessile, usually crowded in the center; disk light buff to reddish buff, mostly concave with a prominent, persistent, entire to sinuate and crenulate thalline margin; epithecium granulose, pale yellow, with KHO darkening to yellowish brown; thecium  $52\ \mu$  high, yellowish orange; paraphyses coherent; hypothecium orange, paling from the center outward; asci inflated-clavate; spores 8, ovoid, 7 to  $12\ \mu$  long,  $4.5$  to  $6\ \mu$  thick.

On granitic rocks in the higher mountains. San Bernardino Mountains, *Parish*; San Gabriel, San Jacinto, and Tehachapi Ranges.

**21a. *Lecanora rubina opaca* (Ach.) Fries.**

Thallus greenish yellow, pediculately affixed as in the species, but less markedly foliose at the margin; disk black.

Of same habitat and distribution as the species. San Bernardino Mountains at 3,400 meters, *Parish*; in the San Jacinto Mountains at a similar elevation.

**22. *Lecanora marginalis* Hasse, Bryologist 13: 112. 1910.**

Thallus monophyllous, white and finely white-pruinose above, roundish or flexuose in outline, 0.75 to 1.5 cm. in diameter, at the center about 0.5 mm. thick, but increasing somewhat toward the circumference, umbilicately attached at the center to the substratum; upper surface smooth or rugulose-warty and at the periphery becoming convolutedly folded, beneath tawny flesh-colored, destitute of rhizinæ; upper cortex composed of several layers of perpendicularly arranged brown cells, bleaching with KHO, beneath this the gonidial layer, the subtending medulla with horizontal, delicate, closely interwoven hyphæ about  $1\ \mu$  thick, the inferior cortex showing several layers of large round cells; thallus with KHO  $\mp$  yellow,  $\text{Ca}(\text{ClO})_2 =$ ; apothecia adnate, all marginal, a few to each frond or when more, crowded and deformed from pressure, 1.5 mm. to less in diameter, the periphery of the frond often revolute and the apothecia facing toward the substratum; disk black, thickly pruinose, rarely naked, concave to flattish and wavy, the turgid thalline margin coarctate, flexuose, and often deformed by juxtaposition; epithecium subcontinuous, dull brownish black; thecium colorless or light ochraceous, 48 to  $52\ \mu$  high; paraphyses stout,  $2\ \mu$  thick, coherent, separating after action of KHO, scarcely thickened above; hypothecium of coarse cells and of the same hue with the epithecium; asci clavate and inflated-clavate,  $48\ \mu$  high, 10 to  $22\ \mu$  thick, 8-spored; spores globular,  $8\ \mu$  in diameter, to ovoid-ellipsoid, 9 to  $14\ \mu$  long,  $6.5$  to  $8.5\ \mu$  thick, the epispore thin; all hymenial structures staining deep blue with iodine; KHO bleaching the epithecium a pale steel blue; gonidia bright green, 12 to  $28\ \mu$  in diameter; spermatogones indicated by generally numerous, minute black dots, immersed, globular; spermatia acicular, curved, 32 to  $40\ \mu$  long, hardly  $1\ \mu$  thick; sterigma simple, straight, attenuate above.

On shaded lava and basaltic rocks near Little Lake Station, Inyo County, at 1,000 meters altitude. From its color a conspicuous lichen; occurring on the lower side of inclined dark volcanic rocks.

**23. *Lecanora pinguis* Tuck.**

Thallus light sulphur yellow, closely adherent, mealy, at the center indistinctly rimose-areolate and turgid-convolute, conspicuously radiate at the periphery, the radii contiguous, paling, flattening and dilated at the border, the hypothallus pallid; thallus with KHO  $+$  yellow,  $\text{Ca}(\text{ClO})_2 +$  bright orange, forming round patches from 2 to 4.5 cm. in diameter; apothecia sessile, centrally crowded; disk concolorous with the thallus, concave or flat, appearing almost urceolate from the turgid, somewhat coarctate, sinuous thalline margin; epithecium continuous, sordid yellowish light brown; thecium 68 to  $72\ \mu$  high, light yellow; paraphyses strict, slender, compacted, not thickened above; hypothecium yellow, about equaling the thecium in height; asci clavate; spores oblong-ellipsoid, 11 to  $15\ \mu$  long, 4 to 5.8 thick; hymenial structures blue with iodine, with KHO yellow; spermatogones not seen.

On sandstone near San Diego, *Orcutt*.



**24. *Lecanora melanaspis alphoplaca* (Wahl.) T. Fries.**

Thallus crustaceous centrally, covered by the numerous apothecia, at the periphery becoming lobed, the lobes oblong or rounded, entire or variously lobed and even stellate in outline, dull brownish gray with a more or less marked whitish margin, the peripheral lobes not closely affixed, whitish beneath, each containing one to several apothecia; apothecia becoming large, from 0.5 mm. to 1.5 mm. wide; disk from plane with an entire, elevated margin to finally convex with the margin obsolete, darker in color than the thallus to at last dull black, a few showing a faint whitish bloom in the center, the greater number naked; epithecium subcontinuous, brown; thecium colorless, 64 to 72  $\mu$  high; paraphyses coherent, thick, about 2 or 3-septate as seen after KHO, not furcate; asci clavate, 40  $\mu$  long, 14  $\mu$  thick, nearly reaching the colored epithecium; hypothecium colorless; spores 8, ovoid, 9 to 11  $\mu$  long, 5 to 6  $\mu$  thick, the epispore thin and indistinct, the spore contents minutely granular, giving the spore-containing ascus the appearance of an *Acarospora*; hymenial gelatine with iodine blue, rapidly changing to a rich, dark copper red, the epithecium not becoming stained; KHO giving finally a sordid orange color; no change with  $\text{NO}_5$ , except a bleaching of the epithecium.

On quartz rock at Eden Hot Spring, Riverside County.

**OCHROLECHIA Mass.**

Thallus crustaceous, uniform, rimose-areolate to warty; spores large; paraphyses branched and intertwining.

**1. *Ochrolechia pallescens* (L.) Mass.**

Thallus thick, white to pale gray, rimose-areolate, the areolae often warty, KHO—,  $\text{Ca}(\text{ClO})_2$ —; hypothallus pallid; apothecia sessile and adnate-sessile, 1 to 3 mm. wide; disk flat, pale yellowish red, smooth or papillate, with a turgid, permanent, erect, entire thalline margin, the disk and margin with KHO ( $\text{Ca}(\text{ClO})_2$ ) + pale red; thecium colorless; paraphyses slender, branching and intertwining; hypothecium colorless, resting upon the gonidial layer; asci elongate-ventricose; spores 8, ellipsoid, 50 to 64  $\mu$  long, 24 to 32  $\mu$  thick; reaction with iodine blue.

On various barks. In southern California in the higher mountains, mostly on bark of *Pseudotsuga macrocarpa*. Santa Catalina Island, *Trask*. Throughout North America; northern Asia; western Africa; South American Andes; Europe.

**LECANIA Mass.**

Thallus crustaceous, uniform, occasionally lobate at the periphery or squamulose, the squamules rarely warty; gonidia *Pleurococcus*.

**KEY TO SPECIES.**

Substratum bark.

Spores 2-locular.

Thallus whitish, thin..... 1. *L. dimera*.

Thallus gray, effuse, thin..... 7. *L. cyrtella*.

Spores 2 to 4-locular; thallus whitish to grayish, chinky... 8. *L. syringea*.

Substratum rock.

Thallus obsolete; apothecia biatorine..... 4. *L. toninioides*.

Thallus present.

Thallus more or less brown.

Reddish brown, verrucose..... 9. *L. dudleyi*.

Pale grayish brownish, squamulose..... 5. *L. brunonis*.

Thallus gray or white.

Gray; squamulose.

Squamules coarse..... 3. *L. turicensis californica*.

Squamules rather small..... 6. *L. subdispersa*.

White..... 2. *L. erysibe*.



**1. *Lecania dimera* (Nyl.) Olivier.**

Thallus thin, whitish, forming small, roundish, smooth patches from 0.5 to 1.5 cm. in diameter, occasionally finely granular, fringed by a pallid hypothallus; apothecia minute, biatorine; disk flattish to convex, light brown and darkening; epithecium granulose, light brown; thecium 60 to 64  $\mu$  high; paraphyses free, not septate, light brown at the tips; asci narrowly clavate, 8-spored; hypothecium colorless or tinted faint yellow; spores oblong-ellipsoid, bilocular, straight or slightly curved, 12 to 16  $\mu$  long, 4 to 4.5  $\mu$  thick; reaction with iodine blue.

On smooth bark of *Juglans californica*.

Canyons of the Santa Monica Range.

**2. *Lecania erysibe* (Ach.) T. Fries.**

Thallus of dispersed or loosely congregated, light ash-colored or whitish pulverulent, small squamules, scarcely exceeding 0.5 mm. in width, KHO—, Ca(ClO)<sub>2</sub>—; apothecia numerous, scattered, sessile, 0.3 to 1 mm. wide; disk flat, soon convex with a delicate bloom, occasionally tuberculate, light brown to light blackish brown, mostly paling toward the circumference, at first with a thin, crenulate thalline margin this at last disappearing; epithecium subcontinuous, dingy yellowish; thecium colorless, 68 to 88  $\mu$  high, staining blue with iodine; paraphyses subcoherent; hypothecium dingy pale yellowish; spores oblong, simple or bilocular, 12 to 16  $\mu$  long, 4.5 to 5  $\mu$  thick.

On calcareous sandstone, Topanga Canyon of the Santa Monica Range; on a similar substratum at Newport Bluffs; on bleached bones on San Nicolas Island, *Trask*.

**3. *Lecania turicensis californica* Zahlbr. Beih. Bot. Centralbl. 13: 159. 1902.**

"A planta typica (Hepp. Flecht. Europ. no. 8) differt thallo epilithico haud evoluto, apotheciis parum minoribus, normaliter pruinosis, madefactis fuscis et sporis angustioribus, 10 to 12  $\mu$  longis et 3.5 to 4  $\mu$  latis."

On calcareous rock, Santa Ynez Canyon of the Santa Monica Range.

The only specimen found was deposited with Dr. A. Zahlbruckner and the plant has not been collected since.

**4. *Lecania toninioides* Zahlbr. Beih. Bot. Centralbl. 13: 160. 1902.**

Thallus an ash gray squamulose crust; squamules small, roundish, angular or sinuate-lobate, concave, contiguous and subimbricate, the border whitish; apothecia dispersed, adnate-sessile to sessile, 1 to 1.5 mm. wide; disk flat to lightly convex, at times slightly depressed in the center, dusky grayish with a faint bloom, the thalline margin whitish, thin, entire, becoming obsolete; epithecium subgranulose; thecium pallid, 70 to 90  $\mu$  high; paraphyses coherent, not septate, tips clavate, brownish; hypothecium pale; asci oblong-clavate, equaling the thecium in height; spores 8, fusiform-oblong, bilocular, straight or lightly curved, 15 to 20  $\mu$  long, 4 to 5  $\mu$  thick; spermatia hook-shaped, 16 to 20  $\mu$  long, about 1  $\mu$  thick.

On clay. Type locality, Ballona Bluffs, near Santa Monica.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**5. *Lecania brunonis* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 188. 1910.**

*Lecanora brunonis* Tuck. Gen. Lich. 116. 1872.

Thallus of small verrucae or flattening to squamules forming an areolate crust, greenish gray to greenish brown, at times the squamules round or crenulate, contiguous or imbricate, the color darkening to dull greenish black, KHO—, Ca(ClO)<sub>2</sub>—; apothecia adnate-sessile; disk brown to dull blackish, concave to flat, the thalline margin crenulate and sinuate, finally obscure; epithecium umber brown, continuous, paling downward; paraphyses strict, coherent, some forked below the globular heads; thecium colorless or pale yellowish, 100  $\mu$  high; hypothecium amber color; asci inflated-clavate, 80 to 86  $\mu$  high; spores 8, bilocular, oblong-ellipsoid, 12 to 20  $\mu$  long, 4 to 7  $\mu$  thick; hymenial gelatine with iodine intense blue; spermatia hook-shaped, 16 to 24  $\mu$  long.



On sandstone boulders in the Santa Monica Range; near Murietta, Riverside County; not seen in the higher mountains; on Santa Catalina Island. Type locality near Oakland, California.

**6. *Lecania subdispersa* (Nyl.).**

*Lecanora subdispersa* Nyl.; Hasse, Lich. South. Calif. 12. 1898.

Thallus crustaceous, of small, pale gray or grayish greenish, imbricated squamules forming small, scattered patches (in the type specimen squamules of sterile *Lecania brunonis* intermixed); apothecia sessile, minute, not exceeding 0.8 mm. in width; disk flat, dull reddish brown and blackening, the lighter colored margin at last disappearing; epithecium subcontinuous, light brown, staining violet brown with KHO; thecium 60 to 68  $\mu$  high, violet brown at upper third, below colorless; paraphyses separate, colored at the clavate tips; hypothecium colorless or light brownish to brown; asci oblong-ellipsoid, 44  $\mu$  long, 12  $\mu$  thick; spores 8, ellipsoid, 9 to 13  $\mu$  long, 3 to 4.5  $\mu$  thick, bilocular; sterigma simple, straight; spermatia acicular, slightly curved to arcuate.

On a sandstone boulder in "Stone Canyon," Santa Monica Range (type locality); at Newport Bluffs on sandstone.

**7. *Lecania cyrtella* (Ach.) Olivier.**

Thallus dark gray, when moist greenish gray, smooth or chinky and finely pulverulent, uniform, effuse; apothecia minute, impressed-sessile, from brick red with a lighter colored margin (the latter finally obsolete), darkening to brown and lurid blackish; epithecium grayish; paraphyses coherent; thecium 60  $\mu$  high; asci inflated-clavate and subpyriform; spores 8, ellipsoid, bilocular, colorless, 10 to 16  $\mu$  long, 3 to 5  $\mu$  thick; hymenial gelatine with iodine staining a dark claret color.

On various barks in the Santa Monica Range.

**8. *Lecania syringea* (Ach.) T. Fries.**

Thallus whitish or grayish white, glaucous, smooth or finely rimose-areolate, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia adnate-sessile, 0.25 to 1 mm. wide; disk flat to light convex, pale grayish flesh color with a bloom to almost black, the moderate, thin, entire thalline margin persistent; epithecium subcontinuous, dull violaceous brown, gradually paling downward; thecium 60 to 72  $\mu$  high, colorless, with iodine blue; paraphyses subcoherent, not septate, clavate and slightly colored at the tips; hypothecium colorless; asci clavate; spores 8, oblong or ellipsoid-oblong, bilocular to quadrilocular (the former state more frequent with us), 12 to 20  $\mu$  long, 5 to 7  $\mu$  thick, often slightly curved. A form occurs at Del Mar on dead bark of oak with a marked pruinose disk.

Common in southern California; San Bernardino, *Parish*. Northern part of North America and Europe.

The variety *metabolica* Nyl., with small, dark brown to blackish biatorine apothecia, occurs in canyons of the San Gabriel Range on bark of *Acer macrophyllum*.

**9. *Lecania dudleyi* Herre, Proc. Washington Acad. Sci. 12: 188. 1910.**

Thallus crustaceous, of cartilaginous, coarse, semiglobular warts, grouped or dispersed, light brown to red brown; apothecia primarily immersed in the warts, then innate-sessile, forming a cupola to the thalline wart; disk dark brown, papillate, the proper margin indistinct, the gonidial layer subtending the hypothecium; thecium 96  $\mu$  high; paraphyses adglutinate; hypothecium colorless; spores 8, bluntly ellipsoid, bilocular, 12 to 16  $\mu$  long, 6 to 7.5  $\mu$  thick; hymenial gelatine dark blue with iodine.

On calcareous rocks on the beach at White Point, near San Pedro, and at Highland Park, near Los Angeles, upon the same substratum.



**PLACOLECANIA** (Steiner) Zahlbr.

Thallus crustaceous; spores 2 to 4-locular; sterigma simple or branched, endobasidial.

1. **Placolecania candicans** (Fries) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 11\*: 205. 1907.

*Lichen candicans* Dicks. Pl. Crypt. Brit. 3: 15. 1793.

Thallus whitish, mealy, forming round patches, areolate-rimose in the center or squamulose, the scales somewhat dispersed and then lobulate, at the circumference becoming lobulate-radiate, KHO—; apothecia sessile; disk dull brown black, with a faint bloom and with a turgid, finely crenulate thalline margin; epithecium grayish brown, subcontinuous; thecium colorless, 96 to 102  $\mu$  high, with iodine deep blue; paraphyses coherent, strict, not septate nor forked, the tips capitate and slightly colored; hypothecium nearly colorless or with a very faint yellowish tint; asci clavate, 8-spored; spores oblong-ellipsoid, 11 to 17  $\mu$  long, 4 to 5  $\mu$  thick; spermatia staff-shaped, 4 to 8  $\mu$  long, 1  $\mu$  thick; sterigma straight, simple; gonidial layer extending under the hypothecium.

On calcareous rocks, Santa Catalina Island, and argillaceous shale in the Santa Monica Range.

**PHLYCTIS** Wallr.

Thallus crustaceous, thin, spreading, scaly-pulverulent; apothecia persistently immersed, the thalline margin irregularly lacerate; asci 1 or 2-spored; spores colorless, oblong-ellipsoid, muriform, the epispore thin; sterigma simple; spermatia elongate, straight.

## KEY TO SPECIES.

- Spores with blunt, rounded ends..... 2. *P. argena*.  
 Spores with an acuminate cell at each end..... 1. *P. agelaea*.

1. **Phlyctis agelaea** (Ach.) Koerb.

Thallus subdeterminate, thin, white or oftener grayish white, mealy, KHO+yellow, then red; apothecia very small; disk black, white-pruinose; thalline margin thin, white, pulverulent; epithecium yellowish brown, granulose, with KHO+orange brown; thecium 120  $\mu$  high, colorless, with iodine the hymenial gelatine yellowish, the ascus wall permanently blue; paraphyses separate; hypothecium similar to the epithecium, with iodine brown; asci ventricose, 88  $\mu$  long, 24  $\mu$  thick; spores 2 or sometimes solitary, muriform-multilocular, decolorate, at each end a small but distinct apical, acuminate cell, 48 to 84  $\mu$  long, 14 to 20  $\mu$  thick, with iodine staining yellow to orange; sterigma simple; spermatia short, straight.

On barks (*Populus trichocarpa* and *Salix lasiolepis*) in canyons of the Santa Monica Range; on *Acer macrophyllum* in the San Gabriel Range.

2. **Phlyctis argena** (Ach.) Koerb.

Thallus thin, white, smooth or slightly rugulose, effuse, KHO+yellow, then red, particularly the thalline margin; hypothallus pallid; apothecia adnate, small, not exceeding 0.5 mm. in width; disk brown black to black, flat; thalline margin white, pulverulent, crenulate, often thickly pruinose, semitranslucent when moist; epithecium granulose, yellowish; thecium colorless, 104 to 140  $\mu$  high; paraphyses separate, simple, not thickened at the adglutinated apices; hypothecium colorless or dingy brown; asci 169  $\mu$  long, 80  $\mu$  thick; spores solitary, 100 to 140  $\mu$  long, 44  $\mu$  thick, colorless, muriform, oblong, with rounded ends; with iodine the asci staining blue and the spores yellow.

On barks, Santa Cruz Mountains, *Herre*; in the canyons of the Santa Monica and San Gabriel Ranges.



**CANDELARIELLA** Muell. Arg.

Thallus crustaceous, uniform, granular to warty, now and then lobed at the periphery, yellow to orange, not stained by KHO; apothecia sessile, circular, lecanorine, yellow; asci 8-sporous to multisporeous, the spores simple or bilocular; sterigma sparingly jointed; spermatia short, straight.

## KEY TO SPECIES.

- Thallus effuse, minutely squamulose; disk yellow..... 1. *C. vitellina*.  
 Thallus granulose, greenish yellow; disk grayish yellow..... 2. *C. cerinella*.

**1. Candelariella vitellina** (Ehrh.) Muell. Arg.

Thallus effuse, citrine yellow, of minute round and crenate, lobulate squamules; apothecia sessile; disk flat, concolorous with the thallus, the thalline margin entire or now and then finely crenulate; epithecium granulose, yellow; thecium colorless, with iodine blue, KHO—; paraphyses free, slightly clavate, some furcate and jointed below the tips; hypothecium colorless; asci inflated-clavate; spores 8, 10 to 16  $\mu$  long, 4 to 4.5  $\mu$  thick, simple and bilocular, the septum disappearing after KHO.

On barks, dead wood, rocks, and earth upon rocks. Common throughout the United States and Canada; Europe; South America (Bolivia); western Africa; Oceania.

**2. Candelariella cerinella** Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 207. 1907.

*Lecanora cerinella* Floerke in Steud. & Hochst. Enum. Pl. Germ. Helv. 1826, nomen nudum.

Thallus thin, of greenish yellow, round granules, dispersed or crowded, KHO—, Ca (ClO)<sub>2</sub>—; apothecia sessile; disk plane or slightly convex, greenish yellow; thalline margin thin, crenulate; epithecium continuous, greenish yellow; thecium colorless, 44 to 80  $\mu$  high, blue with iodine; paraphyses strict, subcoherent, septate and clavate at the thickened and sometimes globular capitate tips; hypothecium yellowish or colorless; asci subinflated-clavate, the membrane thickened at top; spores 8, oblong-ellipsoid, 13 to 20  $\mu$  long, 5 to 7  $\mu$  thick, simple or faintly bilocular, some slightly curved.

On rocks and earth upon rocks. Palm Springs, Riverside County; in the Santa Monica Range on argillaceous shale; Yosemite Valley over moss on rocks. Perhaps generally distributed, but overlooked from its similarity to the preceding species.

**PARMELIACEAE.**

Thallus foliaceous, spreading or ascending, or sometimes fruticulose; gonidia Pleurococcus; apothecia circular with a thalline margin, sessile or subpedicellate; asci with 6 to 8 spores, rarely more.

## KEY TO GENERA.

- Apothecia on upper surface, sessile or subsessile..... **PARMELIA** (p. 99).  
 Apothecia mainly marginal or nearly so..... **CETRARIA** (p. 103).

**PARMELIA** Ach.

Thallus foliaceous, horizontally spreading, variously lobed, rarely ascending; apothecia cup-shaped with a thalline margin; spermogones imbedded; sterigmata loosely branching, septate, peculiarly and characteristically bayonet-shaped; spermatia short, straight; spores in 8's, rarely more, colorless, simple, from ellipsoid to almost globular.

Some of the species are not well defined in their gross external characters and a concise, brief description is difficult, therefore the chemical reactions are an important aid to determinations.



## KEY TO SPECIES.

Thallus loosely affixed, the lobes inflated.

Greenish gray above; lobes flattening at border..... 12. *P. physodes*.

Gray above; lobes linear and deeply cleft..... 13. *P. enteromorpha*.

Thallus closely affixed, horizontally expanded.

Thallus light colored.

Thallus light straw-colored or pale greenish.

Beneath black.

Small and narrowly lobed; with KHO + yellow..... 14. *P. subcapitata*.

Large and broadly lobed.

Thallus finely wrinkled; medulla with KHO + yellow, with  $\text{Ca}(\text{ClO})_2$ —.. 1. *P. cylisphora*.

Thallus smooth; medulla with KHO— with  $\text{Ca}(\text{ClO})_2$  + red..... 2. *P. olivetorum*.

Beneath dark but not black.

Broadly expanding.

Thallus with KHO + yellow; fruiting freely..... 3. *P. conspersa*.

Thallus with KHO —; sterile..... 4. *P. subconspersa*.

Not broadly expanding; lobes narrow..... 3a. *P. conspersa stenophylla*.

Thallus light gray.

Smooth above.

Lobes ascending; sterile with us..... 5. *P. perlata*.

Lobes less ascending, broadly laciniate; fruiting freely..... 6. *P. tiliacea*.

Reticulate-lacunose above..... 7. *P. saxatilis*.

Thallus dark brown.

Beset with concolorous small warts..... 10. *P. exasperata*.

Not beset with warts.

Slightly wrinkled above.

Spores more than 8..... 9. *P. multispora*.

Spores not more than 8..... 11. *P. glabra*.

Not wrinkled above, glistening..... 8. *P. olivacea*.

### 1. *Parmelia cylisphora* (Ach.) Wain.

Thallus orbicular, expanded, sometimes to a width of 20 cm., pale greenish yellow, interruptedly radiate, rugose, pulverulent, isidiose, except at the border lobes, these smooth, broadly laciniate, round-lobed, the periphery suberect, entire or crenate, beneath deep black, the periphery light brown, with short, black, dispersed rhizinae, smooth, with KHO both layers yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia rather rare, when present medium large, the largest barely 2 mm. wide; disk concave, red brown, with an erect, often pulverulent thalline margin; epithecium subcontinuous, sordid greenish yellowish; thecium 52 to 56  $\mu$  high, the lower half colorless; hypothecium colorless; asci inflated or cuneiform, 35  $\mu$  long, 16  $\mu$  thick; spores ovoid-ellipsoid, 10 to 16  $\mu$  long, 7 to 9  $\mu$  thick.

On boulders and dead and living bark. Santa Monica, San Gabriel, and Verdugo Mountains. North and South America; Europe; Hawaiian Islands.

### 2. *Parmelia olivetorum* (Ach.) Nyl.

Thallus pale greenish (a specimen determined by Nylander in 1898 now dusky yellow in the herbarium), orbiculate, widely spreading, from 5.5 to 12 cm. in width, laciniate-lobed, the laciniae contiguous and the border entire or coarsely round-crenate;



upper surface smooth or papillate, rugulose, in the center and at the border of the laciniae often with isidia of the same color with the thallus, beneath dark brown black, at the border brown and glistening; rhizinae few and short, with KHO cortex yellow, the medulla not stained, with  $\text{Ca}(\text{ClO})_2$  the cortex not stained, the medulla red.

On oak bark, canyons of the Santa Monica Range. Fruiting specimens have not been found. Determined by the late Dr. W. Nylander.

### 3. *Parmelia conspersa* (Ehrh.) Ach.

Thallus greenish straw color, orbicular-spreading, often extensively, appressed, laciniate-divided and lobate, the lobes and laciniae, except at the extreme margin, round-crenate, the center variously rugose, beneath dingy brownish blackish, with KHO the cortex yellow, the medulla yellow, then red,  $\text{Ca}(\text{ClO})_2=$ ; apothecia numerous, elevated-sessile; disk dark chestnut to almost black, concave to flat, with an incurved, crenulate thalline margin; epithecium continuous, colorless to dusky yellowish; thecium with a faint yellowish shade, 40 to 44  $\mu$  high; paraphyses coherent with slightly capitate tips; hypothecium colorless; asci clavate; spores 8, ovoid 8 to 12  $\mu$  long, 5 to 8  $\mu$  thick; all hymenial structures stained blue with iodine, KHO—.

Rocks and boulders, frequent throughout and often spreading extensively. North America to the Arctic; South America; Australia and Tasmania; Europe.

The forma *isidiata* Leight. has the upper surface thickly beset with concolorous isidia, excepting the extreme border, but is otherwise similar to the species with which it is found, though less frequently in fruit.

### 3a. *Parmelia conspersa stenophylla* Ach.

Orbicular, less spreading, 3 to 5 cm. wide, appressed; laciniae narrow, almost linear, dilating at the border, more separate than in the species; sparingly fruiting.

On rocks; San Bernardino Mountains, *Parish*; occasional in the Santa Monica Range; frequent on clay and sand rock near Del Mar.

### 4. *Parmelia subconspersa* Nyl.

Thallus pale greenish straw color, orbicular, from 5 to 10 cm. wide, laciniate-lobate, the laciniae contiguous and subimbricated, the border more or less ascending, at the center the borders not seldom sorediate, beneath light brown to blackening, the rhizinae few and short; apothecia as in *P. conspersa*, to which it is very similar, differing only in the medulla not staining yellow with KHO. It is rarely found fruiting.

On boulders in the Santa Monica and San Gabriel Ranges with *P. conspersa* but less frequent.

### 5. *Parmelia perlata* (L.) Ach.

Thallus dilated, spreading, deep and wide-lobed, with entire or sublobulate border, smooth above, the lobes suberect, the margin often turgidly sorediate, beneath black with scattered, short rhizinae, at the border brown, smooth, somewhat glistening, with KHO the cortex deep yellow, the medulla yellow,  $\text{Ca}(\text{ClO})_2=$ ; apothecia not found in our district.

Rocks, bark, and earth. On earth, Santa Catalina Island, *Trask*; on twigs and earth at base of rocks in the Santa Monica Mountains; on trunks in the San Jacinto and San Gabriel Mountains. Northern United States to Mexico; South America; Polynesia; Australia; and Europe.

### 6. *Parmelia tiliacea* (Hoffm.) Ach.

Thallus whitish or faint cream color, deeply lobed, the lobes roundish-crenately cut, contiguous and imbricate; upper surface undulate in the center, flattening toward the circumference, irregularly orbiculate, moderately loosely affixed, beneath black, fibrillose, naked, smooth, and glistening at the border, with KHO the cortex yellow, the medulla unchanged, with  $\text{Ca}(\text{ClO})_2$  the cortex unchanged, the medulla red; apothecia sessile, 2 to 5.5 mm. wide, numerous and crowded at the center; disk reddish to chestnut, flat, undulate, the thalline margin entire or subcrenate, persistent;



epithecium continuous, pale reddish brown, gradually paling downward; thecium 68 to 72  $\mu$  high, colorless, with iodine blue, the epithecium retaining its natural color; paraphyses coherent; hypothecium of the same tint as the epithecium, but paler; asci clavate; spores 8, ellipsoid, 8 to 16  $\mu$  long, 5 to 8  $\mu$  thick.

On various barks. Oaks in the Yosemite valley, the lobes small and closely adherent; canyons of the San Gabriel Mountains; San Jacinto Mountains (Strawberry Valley) at 1,600 meters. Rarely on rocks. San Diego, *Alderson*, and in San Antonio Canyon, San Gabriel Range. Common in North America; Mexico; South America; Europe, Asia, and Africa.

**7. *Parmelia saxatilis* (L.) Ach.**

Thallus orbiculate, light grayish or pale yellowish gray, comparatively narrowly lobate-laciniate, the laciniae short, sinuate, smoothish or shallow-lacunose, beneath smooth, black, glistening, with few rhizinae, with KHO the cortex yellow, the medulla red, with  $\text{Ca}(\text{ClO})_2$ —; fruiting specimens not seen.

On moss-covered rocks at base of trees and among moss on earth in the San Gabriel Range at 1,600 meters altitude.

**8. *Parmelia olivacea* (L.) Ach.**

Thallus orbicular, appressed, brown to dark brown, deeply laciniate-lobed, the lobes imbricate at the center, then contiguous or at the circumference becoming somewhat discrete, the margin crenately cut, smooth and more or less glistening above, KHO—,  $\text{Ca}(\text{ClO})_2$ —; beneath dark with dark fibrils; apothecia often numerous at the center, sessile, 0.5 to 2 mm. wide; disk concave, concolorous with the thallus or reddish brown, glistening; thalline margin thin, almost entire to crenulate; epithecium subcontinuous, yellowish brown; thecium 60 to 64  $\mu$  high, colorless; paraphyses coherent; hypothecium colorless; asci inflated-clavate; spores 8, ovoid-ellipsoid, 8 to 11  $\mu$  long, 6 to 8  $\mu$  thick; sterigma articulate, branching; spermatia straight, 8 to 12  $\mu$  long and apparently 1  $\mu$  thick.

On barks and rocks; common and variable throughout our mountains, ascending from the plains. San Bernardino, *Parish*; Santa Cruz Mountains, *Herre*.

**9. *Parmelia multispora* A. Schneid.**

Thallus orbicular, closely appressed to smooth bark of trees and twigs (and dead wood), the border roundish, entire or incised, KHO=,  $\text{Ca}(\text{ClO})_2$ —, beneath dark with short black fibrils, brown and devoid of fibrils at the border; disk brown, flat-concave, now and then rugose-verruculose; thalline margin entire, finally obscure; epithecium continuous, brown, gradually paling downward; thecium 60 to 64  $\mu$  high, stained blue with iodine, except the epithecium, this not affected by the reagent; paraphyses coherent; hypothecium colorless; asci inflated-clavate; spores 16 to 24 in ascus (50 to 100, as stated by Schneider, not observed), ovoid, from 8 to 9  $\mu$  long, 5 to 8  $\mu$  thick, or globular and from 6 to 8  $\mu$  in diameter.

The thallus differs from that of *P. olivacea* in being less spreading. Spermatogones not seen.

San Bernardino Mountains, *Parish*; on shrubs in the Santa Monica and San Gabriel ranges, not infrequent.

**10. *Parmelia exasperata* (Ach.) Nyl.**

Thallus orbicular, brown, densely beset above with erect, concolorous papillae, the lobes narrower than in *P. olivacea*, in typical forms only the ends of the laciniae crenulate and free of papillae, KHO—,  $\text{Ca}(\text{ClO})_2$ —, beneath dark with short dark rhizinae; apothecia sessile, disk concave to flat and undulate, of the color of the thallus; thalline margin persistent, entire or finely crenulate and with papillae; epithecium continuous, pale yellowish brownish, overlaid by a thin hyaline membrane; lower half of thecium colorless; paraphyses coherent; hypothecium colorless; asci clavate, 40  $\mu$  long, 10 to 12  $\mu$  thick; spores 8, ovoid, 8 to 10  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine and asci bluish with iodine, the epithecium and hypothecium not affected, KHO—.



On barks and rocks with *P. olivacea*, perhaps less frequent. San Bernardino Mountains, *Parish*.

#### 11. *Parmelia glabra* Schaer.

Thallus orbiculate, closely affixed, from olive green darkening to umber brown, radiately folded or undulate, the surface wrinkled, becoming smooth at the deeply lobed circumferences, the border crenate, medulla KHO—,  $\text{Ca}(\text{ClO})_2$ +red; apothecia scattered or crowded centrally, sessile; disk concave to flat and undulating; thalline margin erect, coarsely crenate; epithecium continuous, light yellowish brown; thecium colorless,  $60\ \mu$  high, blue with iodine, the epithecium and hypothecium not staining, however; paraphyses loosely coherent; hypothecium colorless; asci clavate; spores 8, ovoid,  $14$  to  $18\ \mu$  long,  $7.5$  to  $10\ \mu$  thick.

On barks. San Antonio Canyon, San Gabriel Range at 1,600 meters altitude and at "Seven Oaks," San Bernardino Mountains.

#### 12. *Parmelia physodes* (L.) Ach.

Thallus light greenish gray, stellate-orbiculate, loosely affixed, radiately divided, tubular, subinflated, somewhat flattened, with KHO the cortex yellow, the medulla not affected, with  $\text{Ca}(\text{ClO})_2$ =; epithecium continuous, hyaline; thecium sordid yellowish, with iodine indigo blue, KHO—; paraphyses coherent; hypothecium colorless; asci inflated-clavate or cuneiform; spores 8, globular and ovoid-ellipsoid,  $4$  to  $7.5\ \mu$  long,  $4\ \mu$  thick; apothecia subpedicellate; disk chestnut-colored, with an inflated thalline margin.

Sparingly on barks in the San Gabriel Range. Eastern United States and northward; Pacific Coast; Tasmania; Europe.

#### 13. *Parmelia enteromorpha* Ach.

Thallus suberect, deeply divided, the linear divisions tubular-inflated, laciniately parted, whitish gray to gray above, their black margin passing into black beneath, KHO+yellow, the medulla KHO+ $\text{Ca}(\text{ClO})_2$ +red; apothecia sessile or subpedicellate, inflated, funnel-shaped; disk chestnut, glistening, flat becoming convex, the crenulate, slightly inflexed thalline margin then obscure; epithecium continuous, reddish, paling downward; thecium  $40$  to  $44\ \mu$  high; the lower part colorless; paraphyses coherent; hypothecium colorless; asci clavate; spores 8, subglobular,  $5$  to  $8\ \mu$  long,  $4$  to  $6\ \mu$  thick, the gonidial layer continuing beneath the hypothecium; spermatogonia indicated as black, generally frequent dots.

Frequent on shrubs and trees in the mountains. Santa Catalina Island, *Trask*; San Bernardino Mountains, *Parish*; Lower California, *Orcutt*; Guadalupe Island, very luxuriant, 15 cm. in diameter, *Franceschi*.

#### 14. *Parmelia subcapitata* Nyl.

Thallus as seen small, orbicular, pale straw color, closely adherent, centrally isidiose, at the periphery laciniate-lobed, beneath black, with KHO the cortex yellow, the medulla unchanged, KHO+ $\text{Ca}(\text{ClO})_2$ —, sterile.

On twigs at San Diego, *Alderson* (communicated by S. B. Parish). Determination by the late Doctor Stizenberger. The sterile specimen is too fragmentary to allow a full description.

### CETRARIA Ach.

Thallus foliaceous with ascending lobes or fruticulose; apothecia marginal or terminal, circular with a thalline margin; spores colorless, small, simple, ovoid to ellipsoid; gonidia Protococcus; sterigma sparingly branched, short; spermatia ellipsoid to clavate.

#### KEY TO SPECIES.

Thallus foliaceous.

- |                                |                           |
|--------------------------------|---------------------------|
| Yellow.....                    | 1. <i>C. juniperina</i> . |
| Green or a shade of green..... | 2. <i>C. lacunosa</i> .   |



Thallus fruticulose, dark.

- Compressed throughout. . . . . 4. *C. saepincola*.  
 Branches subterete. . . . . 3. *C. californica*.

**1. *Cetraria juniperina* (L.) Ach.**

Thallus a rich chrome yellow, foliaceous, erect or suberect, about 0.5 cm. high, the lobes longitudinally furrowed and slightly lacunose, lacerate at the edges; apothecia adnate, submarginate on the upper surface; disk brown, concave, shining; thalline margin persistent, crenulate; epithecium yellowish brown, sharply defined below; thecium 52 to 56  $\mu$  high, the upper part pale yellowish tinted; paraphyses adglutinate, ill defined, with small yellow heads; hypothecium colorless; asci oblong-clavate, the membrane thickened above; spores 8, ovoid-ellipsoid, 8 to 9  $\mu$  long, 4.5 to 5.5  $\mu$  thick; hymenial gelatine blue with iodine, soon changing to brownish, a narrow hyaline border of the epithecium remaining unaffected.

On barks. Monterey Bay, *Herre*; dead limbs of conifers at Wauwona, in the Sierra Nevada. Throughout the eastern United States to arctic America; Europe.

**2. *Cetraria lacunosa* Ach.**

Thallus foliaceous, grayish green, lacunose-rugulose, deeply parted from the base, the lobes subascending, dilated outward and the border lacerate-laciniate, beneath whitish, in places blackening; apothecia terminal; disk brown, at last planoconvex and rugulose; thalline margin thin, entire; epithecium continuous, pallid flesh-colored or pale brown, paling below; thecium 48 to 50  $\mu$  high; paraphyses loosely adglutinate; hypothecium colorless; asci clavate; spores 8, ovoid-ellipsoid, 8 to 8.5  $\mu$  long, 4.5 to 5  $\mu$  thick; thallus with KHO=; hymenial gelatine with iodine pale blue, soon greenish, then sordid brown; spermatia ellipsoid, 3 to 4  $\mu$  long, 1  $\mu$  thick.

On pines, Squirrel Inn, San Bernardino Mountains, *Reed*.

**3. *Cetraria californica* Tuck.<sup>1</sup>**

Thallus fruticulose, suberect and erect, greenish brown to almost black, paler beneath, the lobes terete-compressed, lacunose and longitudinally furrowed, soon intricately branching up to the finely lacerate termination; apothecia terminal and subterminal, 2 to 5 mm. wide, subpedicellate; disk concave to planoconvex, concolorous with the thallus; thalline margin thin, crenulate and finally almost obsolete; epithecium continuous, a thin brown band; thecium 80  $\mu$  high, pallid, staining blue with iodine, except the epithecial border (20  $\mu$  wide), this not affected; paraphyses coherent; hypothecium colorless; asci inflated-clavate, with iodine darker blue than the other parts; spores 8, ellipsoid, 10 to 11  $\mu$  long, 4.5 to 5  $\mu$  thick; blue stain gradually changing to light brown, after KHO the paraphyses appearing indistinctly septate.

On living or dead shrubs and limbs of trees, preferably conifers. Rare in the Santa Monica Range, but frequent in the higher ranges.

**4. *Cetraria saepincola* (Ehrh.) Ach.**

Thallus grayish green to almost black, suberect to erect, 0.5 to 0.75 cm. high, irregularly laciniate-lobate, paler beneath, KHO—, Ca(ClO)<sub>2</sub>—; apothecia adnate, marginal and lateral; disk concave to flat, green black to black, glistening as if varnished; thalline margin entire, persistent; epithecium continuous, brownish yellowish, paling downward; thecium 36 to 40  $\mu$  high, colorless below; paraphyses adglutinated; hypothecium of a paler hue than the epithecium; asci clavate; spores 8, 9 to 12  $\mu$  long, 6 to 8  $\mu$  thick; with iodine the epithecium not stained, the other thecial structures blue.

<sup>1</sup> Dr. R. Heber Howe, jr., in his *Classification de la Famille des Usneaceae dans l'Amérique du Nord* (p. 20, Paris, 1912) transposes *Cetraria californica* to the genus *Coelocaulon* Link as *Coelocaulon californicum* (Tuck.) Howe.



On limbs of conifers in the Tehachapi, San Gabriel, and San Jacinto ranges. Northern United States to arctic America; Europe; mountains of northern and middle Asia; Auckland and New Zealand.

The variety *chlorophana* Wahlenb. (Santa Cruz Mountains, *Herre*), has not been reported from our district.

### USNEACEAE.

Thallus fruticulose, erect to pendulous and elongate-pendulous, terete, terete-compressed, and foliaceous-compressed, corticate throughout, affixed to the substratum by a common basal plate; apothecia circular, shield or dish-shaped, lecanorine; spores from solitary to 8, colorless, simple or bilocular in our species; gonidia Protococcus.

#### KEY TO GENERA.

- Spores bilocular; thallus light straw or pale greenish, compressed-foliaceous or terete-compressed..... *RAMALINA* (p. 105).  
 Spores simple.  
   Thallus brown to black..... *ALECTORIA* (p. 109).  
   Thallus of some lighter color.  
     Thallus rich yellow..... *LETHARIA* (p. 110).  
     Thallus pale greenish.  
       Compressed, linear, sterile with us..... *EVERNIA* (p. 109).  
       Terete..... *USNEA* (p. 108).

### RAMALINA Ach.

Thallus fruticulose, erect or pendulous, affixed by a basal plate to the substratum, branching, seldom nearly foliaceous, terete or subcompressed, corticate throughout; gonidia Protococcus; soredia not rare; apothecia terminal or lateral, cup-shaped or shield-shaped, lecanorine; spores 8, colorless, oblong, ellipsoid to fusiform, straight or lightly curved, bilocular, rarely quadrilocular; sterigma sparingly branched; spermatia short, straight.

#### KEY TO SPECIES.

- Laciniae long-pendulous, fenestrate..... 11. *R. reticulata*.  
 Laciniae erect or nearly so.  
   Terete or subcompressed.  
     Apothecia lateral..... 1. *R. ceruchis*.  
     Apothecia terminal or subterminal..... 2. *R. combeoides*.  
   Compressed.  
     Rigid..... 3. *R. homalea*.  
     Not rigid.  
       Linear-elongate.  
         Canaliculate..... 4. *R. canaliculata*.  
         Not canaliculate, flat.  
           Margins of laciniae sorediate..... 6. *R. farinacea*.  
           Margins not sorediate..... 5. *R. fraxinea*.  
             Beset with black fibrils..... 9. *R. crinita*.  
             Not beset with fibrils.  
               Irregularly branching; apothecia  
               marginal..... 10. *R. menziesii*.  
               Branching at base, furcate at tips;  
               apothecia lateral..... 8. *R. yemensis*.  
     Not linear-elongate, dilated, lacerate, and sorediate  
       above.  
         Low, not over 2 cm. high..... 7. *R. pollinaria*.  
         Taller, 4 to 5 cm. high..... 12. *R. evernioides*.



**1. *Ramalina ceruchis* (Ach.) De Not.**

Thallus tufted, pale straw color, terete becoming often somewhat angular from shallow lacunæ, frequently with small black dots, attenuate upward, often with few short branches above, KHO+ pale yellow, Ca(ClO)—; apothecia lateral and subterminal, 1 to 2 mm. wide; disk concave, delicately whitish pruinose, the thalline margin entire or slightly crenulate; spores 8, oblong, straight or lightly curved, 13 to 20  $\mu$  long, 4 to 5  $\mu$  thick, bilocular.

Not rare along the coast on shrubs; San Clemente Island, *Trask*.

In the forma *cephalota* Tuck. the sterile thallus is besprinkled with cephaloid, isidiose spots and excrescences. It is found with the species. San Clemente Island, *Trask*.

**2. *Ramalina combeoides* Nyl.**

Thallus tufted, sordid light yellowish, subterete, appearing angular from the numerous lacunæ, no reaction of the cortex or medulla with KHO or Ca(ClO)<sub>2</sub>, 1 to 2 cm. in height; apothecia terminal and subterminal, usually several clustered at or below the apex, 2 to 7 mm. wide; disk concave to flattish, pale ochroleucous, the thalline margin entire or crenately cut; spores straight or very lightly curved, 12 to 20  $\mu$  long, 3.5 to 5  $\mu$  thick.

On rocks and shrubs near the coast and on the coast islands; San Clemente Island, *Trask*; on shrubs near San Diego and Newport.

A form occurs near Clifton-by-the-Sea, Los Angeles County, on dead *Sambucus* and *Isomeris arborea*, having the thallus and the thalline margin of the apothecia thickly studded with globular, ochroleucous bodies, their cortical membrane, 28 to 32  $\mu$  thick, composed of compact vertical hyphæ, passing below into a coarse-celled tissue; the cortex containing small gonidia (yellow with KHO), 6 to 12  $\mu$  in diameter, shriveled and distorted; the apothecia, clustered at the apices of the erect thallus tufts, containing oblong spores, mostly straight, 8 to 14  $\mu$  long, 3.5 to 4  $\mu$  thick; all apothecial structures staining blue with iodine.

**3. *Ramalina homalea* Ach.**

Thallus tufted, strongly compressed, 2-edged, sordid light yellowish gray (becoming reddish brown in the herbarium), the surface shallow-lacunose and reticulate-ridged, 3 to 8 cm. high, the sterile fronds gradually attenuating upward, the fertile mostly shorter and wider (0.5 to 2.5 mm. wide), no reaction of thallus or medulla with KHO or Ca(ClO)<sub>2</sub>; apothecia marginal and terminal, 2 to 8 mm. wide; disk pale buff, velvety, concave to flat, finally everted and distorted; thalline margin persistent, stout, entire to slightly sinuate; spores straight; 14 to 18  $\mu$  long, 4 to 5  $\mu$  thick.

Near the coast; Santa Barbara and San Clemente Islands, *Trask*; San Guadalupe Island, *Franceschi*; Santa Catalina Island

**4. *Ramalina canaliculata* Fries.**

Laciniae of the tufted thallus narrow, linear, canaliculate, 3 to 6 cm. high, without soredia, sparingly branching, ascending to erect, glaucous, pale green; apothecia subterminal below the deflected points of the laciniae, small to medium large; disk concave, round, often saddle-shaped, lightly pruinose, the thalline margin persistent, mostly entire; spores bilocular, 12 to 16  $\mu$  long, 4 to 7  $\mu$  thick.

On shrubs and branches of trees throughout the Santa Monica Range; Lower California, *Brandege*.

**5. *Ramalina fraxinea* (L.) Ach.**

Thallus tufted, the laciniae broader and longer than in *R. calicaris*, flat, simple or sparingly divided, not finely attenuate above; upper surface deeply lacunose, now and then fenestrate, or at last loosely fringed with linear, laciniate lobules; apothecia hitherto not found.

Santa Catalina and Santa Barbara islands, *Trask*.



**6. *Ramalina farinacea* (L.) Ach.**

Erect or pendulous, light yellowish or grayish greenish, early dividing into narrow, linear, flattish, faintly longitudinally lacunose laciniae, gradually acuminate above, the margin beset with an almost continuous row of soredia; apothecia (rare) marginal, subpedicellate, not over 1.5 mm. wide, the tips not deflected above the apothecia; disk concolorous, concave; thalline margin finally obsolescent; spores oblong-ellipsoid, straight or lightly curved, 13 to 17  $\mu$  long, 6 to 7  $\mu$  thick.

Frequent throughout on bushes, trees, and fences. Common in North America and Europe.

**7. *Ramalina pollinaria* Ach.**

Thallus tufted, erect, flaccid, pale greenish and pale greenish gray, about 2 cm. high, the laciniae compressed, longitudinally furrowed, glaucescent, narrowing and laciniately cleft into linear lobes above, the larger bursting into sorediate lobules; apothecia not found.

On bushes and branchlets of trees in canyons of the Santa Monica Range.

**8. *Ramalina yemensis* (Ach.) Nyl.**

A sterile specimen collected by Mr. S. B. Parish at Leche Creek, San Bernardino Mountains, has been determined as such by Doctor Stizenberger. It is 2 to 2.5 cm. high, tufted, flaccid, the laciniae compressed, minutely lacunose and longitudinally furrowed, dichotomously divided, the narrowed ends furcate; some of the laciniae with semiglobular black brown tubercles, composed of loose hyphae and brown granular matter; spermogones not seen. The plant is very similar to *Evernia prunastri*.

**9. *Ramalina crinita* Tuck.**

Erect or subpendulous, generally densely tufted, compressed, linear-laciniate to broadly linear, the laciniae deeply divided, both surfaces alike, shallow-furrowed, longitudinally lacunose and occasionally fenestrate, the margins of the laciniae loosely beset with black, long, simple or forked fibrillae, the cortex or medulla giving no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia lateral and subterminal, in the latter case the tip of the lacinia deflexed immediately above the apothecium, subpedicellate, 3 to 8 mm. wide; disk concolorous, concave, then flat and undulate; thalline margin persistent, entire, at first concolorous, later darkening; epithecium continuous, sordid pale yellowish greenish; thecium colorless, 44 to 56  $\mu$  high; paraphyses coherent; asci clavate, 40  $\mu$  long, 10  $\mu$  thick; spores 8, straight and curved, 12 to 16  $\mu$  long, 3.5 to 4  $\mu$  thick; all hymenial structures blue with iodine.

On shrubs, Lower California; on *Euphorbia misera*, near San Diego, *Orcutt*; on *Lycium californicum*, Point Loma, near San Diego. The laciniae are from 2 to 10 cm. in length.

**10. *Ramalina menziesii* Tuck.**

Thallus tufted, erect or pendulous, rigid, the laciniae linear, sparingly divided above, shallow-lacunose and furrowed lengthwise, attaining a length of from 3 to 6 and 8 cm., neither cortex nor medulla giving reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia sessile and pedicellate, marginal, from 2 to 7 mm. wide; disk pale ochroleucous, concave to flat, saddle-shaped and recurved; thalline margin erect, subentire, at last obsolescent; epithecium faint yellow, granulose; thecium 52  $\mu$  high, blue with iodine; paraphyses adglutinate, strict; hypothecium thin, colorless or faint yellowish; asci inflated-clavate; spores 8, 12 to 18  $\mu$  long, 3.5 to 7  $\mu$  thick, oblong, slightly curved, bilocular.

Frequent on shrubs and branches of trees, ascending the mountains to about 800 meters.

The typical plant has flat, compressed laciniae, reticulate with shallow ridges; but there occurs a form with glaucous thallus, without reticulation, but canaliculate, a transition to *canaliculata* as it were.



**11. *Ramalina reticulata* (Noehd.) Kremp.**

Pale green, compressed, pendulous in festoons from limbs of trees, often 1 meter in length or even more, ramifying, the laciniae smooth or furrowed, lacunose and fenestrate, forming an extensive network; apothecia marginal and lateral, sessile; disk concave to flat and the thalline margin then obsolete; epithecium subcontinuous, yellowish; paraphyses coherent; hypothecium colorless; spores 8, 14 to 18  $\mu$  long, 4 to 7  $\mu$  wide, oblong, straight or slightly curved, bilocular; spermogones numerous in the dilated fronds as small protuberances of the color of the thallus; sterigma straight or a little curved and fastigate as it were; spermatia short, straight, 4 to 6  $\mu$  long; KHO giving no reaction.

Frequent in canyons along the coast.

**12. *Ramalina evernioides* Nyl.**

Thallus compressed, suberect or subpendulous, both surfaces flattened, reticulate-lacunose, smoother above, from a broad base soon dividing into laciniae, these irregularly sinuate and laciniate in the upper part, the laciniae often marginally sorediate-torn, 1 to 2.75 cm. high, the cortical hyphae perpendicular to the thalline axis, beneath the cortex the well developed layer of longitudinal hyphae containing the gonidia; fruiting plants hitherto not found.

On shrubs at Point Loma, near San Diego, and also at Newport, Orange County.

**USNEA (Dill.) Adans.**

Thallus fruticulose, filamentose, erect or pendent, often much elongated, terete, branching, smooth or the cortex beset with tubercles or short diverging fibrillae; apothecia circular, the lecanorine margin often ciliate; spores acicular to fusiform.

**KEY TO SPECIES.****Thallus erect.**

- |                             |                          |
|-----------------------------|--------------------------|
| Grayish green, bearded..... | 1. <i>U. hirta</i> .     |
| Reddish, bearded.....       | 2. <i>U. rubiginea</i> . |

**Thallus pendulous.****Cortex fibrillose.**

- |                               |                         |
|-------------------------------|-------------------------|
| Densely short-fibrillose..... | 3. <i>U. ceratina</i> . |
| Loosely short-fibrillose..... | 4. <i>U. dasypoga</i> . |

- |   |                           |
|---|---------------------------|
| Cortex not fibrillose, fissured transversely; smooth..... | 5. <i>U. articulata</i> . |
|---|---------------------------|

**1. *Usnea hirta* (L.) Hoffm.**

Thallus erect, cespitose, dull grayish green or light green, hardly above 3 cm. high, much branched and thickly bearded with short fibrils, sorediate; always sterile.

Common on fences and bushes of the foothills and ascending the mountains. At Del Mar on twigs; Santa Catalina Island, *Trask*.

**2. *Usnea rubiginea* (Michx.) Herre, Proc. Washington Acad. Sci. 7: 343. 1906.**

*Usnea florida rubiginea* Michx. Fl. Bor. Amer. 2: 332. 1803.

Very similar to *U. hirta* and also sterile, but reddish-colored. Of the same distribution and habitat, but less frequent.

**3. *Usnea ceratina* Ach.**

Thallus dusky yellowish green, pendulous, elongated, shortly and more or less densely fibrillose, except at the extremely attenuate terminations, but these, as throughout, besprinkled with small soredia; sterile.

On shrubs, Santa Catalina Island, *Trask*; Santa Cruz Mountains in fruit, *Herre*. Not common with us.

**4. *Usnea dasypoga* (Ach.) Nyl.**

Similar to *U. ceratina*, but less stout and sparingly beset with fibrillae and soredia, pendent, attaining a length of 20 cm.; also sterile.

On shrubs in the San Gabriel Range.



**5. *Usnea articulata* (L.) Hoffm.**

Pendulous, light yellowish grayish green; primary divisions terete, smooth, the continuity of the cortex interrupted by annular fissures; sterile.

On *Abies*, "Grass Valley," San Bernardino Mountains, *Parish*. Apparently rare.

**ALECTORIA Ach.**

Thallus filamentous, pendulous, rarely ascending, elongated, smooth, corticate throughout; apothecia lateral, pedicellate, rare with us.

**KEY TO SPECIES.**

Erect; apothecia with fibrils..... 2. *A. oregana*.

Pendulous, smooth.

Terete, dark brown..... 1. *A. jubata*.

Compressed-terete, straw color..... 3. *A. ochroleuca*.

**1. *Alectoria jubata* (L.) Ach.**

Thallus long-pendulous, dark brown throughout, terete, smooth and glistening, lacunose below, much branched and the capillary terminations intertangled, KHO—; apothecia rare, sessile, lateral; disk concolorous with the thallus, convex and the thalline margin becoming obsolete; epithecium continuous, brown; thecium 36 to 40  $\mu$  high, pale reddish brown or the lower half colorless; paraphyses coherent; hypothecium colorless; asci clavate; spores 8, ovoid-ellipsoid, 6 to 8.5  $\mu$  long, 4 to 4.5  $\mu$  thick; all apothecial structures with iodine blue, KHO—.

On branches of conifers, San Quentin, Lower California, *Greene*. Upon the same substratum in the San Jacinto and San Bernardino Mountains, but generally sterile.

**2. *Alectoria oregana* Tuck.**

Thinly tufted, brown and dark brown, erect, subcompressed, lightly furrowed, sparingly branched or short, brown-fibrillose, the terminations terete, 1.5 to 3 cm. in height, KHO—; apothecia lateral and subterminal; disk dark brown, concave to plane, glistening; thalline margin with brown, short, spreading or deflexed fibrils; epithecium continuous, light brown; thecium colorless, 48 to 52  $\mu$  high; paraphyses coherent; hypothecium colorless; asci clavate, the tops thickened; spores 8, sub-globular, 5 to 6  $\mu$  long, 3.5 to 4  $\mu$  thick; all hymenial structures staining blue with iodine, KHO—; the cortical membrane with longitudinal, sparingly branching hyphæ, those of the medulla freely branching, forming a loosely intertangled network.

On bark of conifers and dead wood. Along the west coast from Washington, *Foster*, to Cape San Quentin, Lower California, *Greene*. Not rare in the Tehachapi Range; at Strawberry Valley, San Jacinto Mountains; in the San Bernardino and San Gabriel Ranges.

**3. *Alectoria ochroleuca* (Ehrh.) Nyl.**

Pale straw color, compressed-terete, branched, the branches somewhat tortuous and interwoven, loosely beset with rather short lateral fibrils; specimen seen sterile, esorediate.

Determined by Doctor Stizenberger.

San Bernardino Mountains, *Parish*.

**EVERNIA Ach.**

Thallus fruticulose, erect or subpendulous, branching, variously lobed; apothecia lateral or subterminal; sterigma jointed, sparingly branched; spermatia acicular, straight.



**1. Evernia prunastri (L.) Ach.**

Thallus soft, pliant, compressed, pale whitish green above, beneath white-channeled longitudinally, divaricately branching, the ultimate divisions linear or often forked at the ends; fruiting specimens thus far not found.

The margins of the laciniae are more or less sorediiferous, and when the soredia are continuous it is the forma *sorediifera* Ach., though its limitation seems a matter of opinion.

Quite common in our district on shrubs and trees, on the mainland as on the islands of the archipelago.

**LETHARIA (T. Fries) Zahlbr.**

Thallus citrine yellow, flattened-terete, fruticulose, branching; medulla loose-webby, irregularly traversed by strengthening cords.

A single species with us.

**1. Letharia vulpina (L.) Wain.**

Fruticulose, erect, about a span high, though oftener not attaining that height, yellow or greenish yellow, terete or subcompressed, lacunose and furrowed; apothecia terminal and subterminal; disk concave to flat, red brown to blackish brown, from 0.5 to 2 or even 3.5 cm. in diameter, the frequently radiately fibrillose thalline margin finally obsolete; spores ovoid-ellipsoid, 5 to 8  $\mu$  long, 4.5 to 5  $\mu$  thick.

With us mostly on conifers, living or dead, rare below 1,500 meters. Mountains of Lower California, *Greene*. Pacific coast and the Rocky Mountains; Europe.

**CALOPLACACEAE.**

Thallus crustaceous, uniform or lobed at the periphery, or reduced-fruticulose; gonidia Protococcus; apothecia circular, innate or sessile, lecanorine or biatorine; spores colorless, polari-bilocular, seldom quadrilocular or simple; sterigma jointed; spermatia short, straight, oblong or ellipsoid.

**KEY TO GENERA.**

- Apothecia biatorine or lecideine; margin without gonidia. . . **BLASTENIA** (p. 110).  
 Apothecia lecanorine. . . . . **CALOPLACA** (p. 112).

**BLASTENIA Mass.**

Thallus crustaceous, uniform, pulverulent or rimose; apothecia innate or sessile, with a proper margin; asci 4 to 16-spored; spores colorless, ellipsoid or oblong, polari-bilocular, rarely quadrilocular or simple; sterigma short, straight, rarely acicular or bowed.

**KEY TO SPECIES.****Substratum bark.**

- Thallus gray, chinky. . . . . 1. *B. ferruginea*.  
 Thallus whitish, granulose. . . . . 1b. *B. ferruginea wrightii*.

**Substratum mineral.****Substratum earth.**

- Apothecia rusty orange, small. . . . . 4. *B. subpyraceella*.  
 Apothecia bright orange to vermilion . . . . . 3. *B. luteominia*.

**Substratum rock.**

- Thallus obsolescent or absent. . . . . 2. *B. festiva*.

**Thallus present.****Ochraceous, poorly developed.**

- Apothecia bright vermilion. . . . . 1a. *B. ferruginea bolanderi*.  
 Apothecia rusty orange. . . . . 4. *B. subpyraceella*.

- Whitish, pulverulent. . . . . 1c. *B. ferruginea fraudans*.



**1. *Blastenia ferruginea* (Huds.) Arnold.**

Thallus determinate or subdeterminate, greenish ash-colored or pale gray, coarsely granular to verruculose and chinky; hypothallus black, more or less distinct; thallus KHO+ purple; apothecia sessile, 0.25 to 0.75 mm. wide; disk flat to lightly convex, rusty red, KHO+ purple; proper margin thin, persistent, entire or nearly so; epithecium subgranulose, yellow to orange; thecium colorless, 88 to 100  $\mu$  high; paraphyses separate with yellowish bulbous heads; hypothecium pallid, yellow; asci clavate; spores 8, ellipsoid and oblong-ellipsoid, 14 to 20  $\mu$  long, 6 to 10  $\mu$  thick, polari-bilocular with an isthmus.

On various barks, rocks, and (rarely) earth; Santa Catalina Island on bark and rocks, in the Santa Monica Range on the same substrata and on earth.

**1a. *Blastenia ferruginea bolanderi* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 228. 1910.**

*Placodium ferrugineum* forma *bolanderi* Tuck. Syn. N. Amer. Lich. 1: 178. 1882.

Thallus thin, sordid pale greenish gray, effuse or absent, KHO—, Ca(ClO)<sub>2</sub>—; hypothallus indistinct; apothecia small, from 0.25 to seldom as much as 1.5 mm. in diameter; disk flat, later convex, bright crimson or often a handsome vermilion color; proper exciple concolorous with the disk or a little lighter, obsolescent in the larger apothecia; disk with KHO dark crimson; epithecium granulose, scarlet, thick, gradually paling downward; thecium 88 to 92  $\mu$  high, colorless, with iodine of an intense blue, including all the hymenial structures, KHO+carmine red or violet blue; paraphyses subcoherent, septate above and faintly colored at the rounded tips; hypothecium colorless or faintly yellowish tinted; asci clavate, the upper third of membrane thickened and the cavity attenuated to a neck above; spores 8, oblong-ellipsoid, approaching subfusiform, straight or some lightly curved, polari-bilocular; the cells approximate, 20 to 27  $\mu$  long, 6 to 8  $\mu$  thick.

On rocks, rarely on clay. Frequent in the Santa Monica Range but not collected in the higher mountains. It may be deserving of the rank of a species.

**1b. *Blastenia ferruginea wrightii* (Tuck.).**

*Placodium ferrugineum wrightii* Tuck. Syn. N. Amer. Lich. 1: 178. 1882.

Thallus crust medium thick, white, granular or obscurely scaly, subdeterminate with an indistinct, dark gray hypothalline border, KHO—; apothecia sessile, from 0.25 to 0.8 mm. wide, KHO+purple; disk dull rust color becoming finally convex; proper margin entire, persistent; epithecium subgranulose, reddish orange or deep orange red, gradually paling downward; thecium colorless below; paraphyses subcoherent; hypothecium colorless; asci clavate; spores broadly ellipsoid, polari-bilocular with an isthmus, 12 to 18  $\mu$  long, 6 to 8.5  $\mu$  thick.

On bark, Santa Catalina Island, *Trask*.

**1c. *Blastenia ferruginea fraudans* (T. Fries).**

*Caloplaca ferruginea fraudans* T. Fries, Vet. Akad. Handl. Stockholm 7: 27. 1867.

Thallus white, thin, effuse, or absent, KHO+ gradually crimson, the reaction appearing slower than upon the disk; apothecia sessile, crowded, small, 0.25 to 1.25 mm. wide; disk pale orange and yellowish orange, flat to convex, the proper margin paler, thin, yellowish, entire, a thin white thalline margin seen in juvenile apothecia but finally disappearing; disk and margins with KHO crimson; epithecium granulose, pale yellow; thecium colorless, 56 to 68  $\mu$  high, this and the epithecium blue with iodine; paraphyses loose, comparatively stout, some with globular pale yellow heads, others barely thickened and colorless at top; hypothecium colorless; asci clavate; spores 8, oblong-ellipsoid, 10 to 15  $\mu$  long, 3 to 5  $\mu$  thick, bilocular or polari-bilocular, the loculi approximate, the isthmus indistinct; epithecium and hymenium with KHO crimson.

On bleached whalebones, San Clemente Island, *Trask*; on arenaceous shale at "White Point" near San Pedro.



**2. *Blastenia festiva* (Fries).***Parmelia ferruginea festiva* Fries, Lich. Eur. Ref. 172. 1851.

Thallus as described "thin, grayish or dark . . . often evanescent," with us absent; apothecia sessile, somewhat larger than in *B. ferruginea*, 0.5 to 1 mm. wide; disk flat soon slightly convex, bright orange and darkening to rusty red; proper margin persistent, entire or crenulate; epithecium subcontinuous, yellow, narrow, its lower border well defined, after KHO purple; thecium 100 to 104  $\mu$  high, colorless, with iodine deep blue; hypothecium sordid yellowish; asci clavate or oblong-ellipsoid; spores oblong-ellipsoid, blunt-ended, 16 to 20  $\mu$  long, 5 to 7  $\mu$  thick, polari-bilocular, the loculi often approaching, or also found bilocular, the septum after KHO widening and the spore then becoming polari-locular with approximate loculi.

Quite frequent on various rocks at lower elevations, though ascending to 1,300 meters.

**3. *Blastenia luteominia* (Tuck.).***Placodium luteominium* Tuck. Syn. N. Amer. Lich. 1: 181. 1882.

Thallus granular, effuse and ill defined, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, grouped, 0.25 to 1 mm. wide; disk flat, orange to vermilion, the proper margin prominent, entire or very faintly striate, with KHO both disk and margin dark crimson; epithecium granulose, yellow to orange yellow; thecium 80  $\mu$  high; paraphyses free, the tips clavate and colored, septate; hypothecium colorless; spores oblong, some slightly curved, with 3 or 4 globules disappearing with KHO, the spores then polari-bilocular, the loculi approximate, without isthmus, 12 to 23  $\mu$  long, 3 to 5  $\mu$  thick.

On sandy clay, Point Loma near San Diego.

**4. *Blastenia subpyraceella* (Nyl.).***Lecanora subpyraceella* Nyl.; Hasse, Bull. Torrey Club 24: 446. 1897.

Thallus clay color, quite thin, obscure or absent; apothecia sessile, small, 0.25 to 0.75 mm. wide; disk pale yellow orange to rusty yellow, flat to planoconvex; proper margin yellow or pale orange, brighter than the disk, thin, persistent, quite entire; thecium 72 to 80  $\mu$  high; paraphyses not well separated, with globular heads, some furcate below the tips; asci oblong-tubular; hymenial gelatine dark blue with iodine; spores 8, oblong-ellipsoid, 12 to 20  $\mu$  long, 6 to 8  $\mu$  thick, polari-bilocular, the cells approximate and connected by a short isthmus.

On earth. Type locality, foothills of the Santa Monica Range near the Soldiers' Home; occurs also on crumbling sandstone.

Type deposited with Dr. W. Nylander in 1897; duplicates with Prof. Bruce Fink and Dr. A. Zahlbruckner, in the herbarium of the New York Botanical Garden, and in herb. Hasse.

**CALOPLACA T. Fries.**

Thallus crustaceous, uniform or lobed at the periphery, or dwarfed-fruticulose, mostly yellow; apothecia circular, appressed or sessile, lecanorine; asci 8-spored; spores colorless, ellipsoid, ovoid or, by bulging of the interocular space, rather rhomboidal, normally bilocular, exceptionally simple or trilocular, the loculi connected by a tube or isthmus; sterigma endobasidial, jointed; spermatia short, straight.

**KEY TO SPECIES.**

- Thallus fruticulose, dwarfish..... 13. *C. coralloides*.  
 Thallus not fruticulose.  
   Thallus crustaceous.  
     Effuse.  
       Yellow..... 5. *C. citrina*.  
       Not yellow.  
         White, thin..... 4. *C. gilva*.  
         White to grayish and obsolete..... 14. *C. pollinii*.



**Thallus not fruticulose—Continued.****Thallus crustaceous—Continued.**

Not effuse.

Chinky or coarsely areolate, yellowish gray..... 1. *C. aurantiaca*.Smooth and continuous, gray..... 3. *C. cerina*.**Thallus squamulose.**

Radiate at the periphery.

Yellow..... 8. *C. cirrochroa*.

Orange.

Radii linear, torulose..... 11. *C. elegans*.Radii not torulose, flattened at periphery..... 10. *C. murorum*.

Not radiate at the periphery.

Squamules white to orange.

White or pale yellow..... 7. *C. fulgens*.

Orange.

Minute..... 6. *C. microphyllina*.Not minute, convex, round or lobulate... 9. *C. bolacina*.

Squamules dark to blackish.

Margin of disk white..... 2. *C. variabilis*.Margin of disk dark..... 12. *C. pellodella*.**1. Caloplaca aurantiaca (Lightf.) T. Fries.**

Thallus coarsely granular and verruculose-areolate, pale citrine yellow or grayish yellow, surrounded by a thin black hypothalline border or this indistinct, KHO+ dark crimson,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, often crowded, 0.5 to 2 mm. wide; disk concave to flat, orange, the citrine yellow thalline margin prominent and persistent, entire to finally crenulate and, at times, at last sinuate; epithecium subgranulose, orange yellow, with KHO purple, as also the heads of the paraphyses; thecium colorless, with iodine deep blue; paraphyses coherent, yellow-capitate; hypothecium milky white; asci clavate; spores 8, ellipsoid, 10 to 15  $\mu$  long, 4.5 to 8  $\mu$  thick, polari-bilocular with a long isthmus.

On various barks, living or dead, and on rocks. Frequent throughout San Clemente Island, *Trask*; cortex of dead *Opuntia*, Newport; on Santa Catalina Island. Cosmopolitan.

**2. Caloplaca variabilis (Pers.) T. Fries.**

Thallus determinate, dark ash color, blackening, rimose-verruculose in the center, squamose at the periphery, the squamules crenulate, KHO+ violet; apothecia adnate, 0.25 or 1 mm. wide; disk flat, color of thallus, the thalline margin entire or finely crenulate, thin, whitish or light gray; epithecium gray, with KHO+ violet; thecium colorless, with iodine blue; paraphyses loosely coherent; the tips with one or two enlargements and a globular head, the latter colored in some paraphyses, septate below the heads, some furcate; hypothecium pale grayish; asci inflated-clavate, 60 to 72  $\mu$  long, 20 to 24  $\mu$  thick; spores 8, blunt-ellipsoid, 15 to 22  $\mu$  long, 5 to 9  $\mu$  thick, polari-bilocular, the loculi approximate, with or without an isthmus; upper third of asci dark, the lower part light blue with iodine, later with the spores turning yellowish.

On sandstone in the Santa Monica Range; on the same substratum near Marietta, Riverside County. Has not been collected at higher elevations.

**3. Caloplaca cerina (Ehrh.) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 228. 1907.**

*Lichen cerinus* Ehrh. Pl. Crypt. Dec. no. 216. 1785.

Thallus thin, effuse, whitish ash-colored, smoothish, or else absent, with KHO tardily pale red; apothecia sessile, small, not over 0.5 mm. wide, crowded in groups; disk flat, light orange, the thalline margin yellowish white, thin, persistent, with KHO



the disk staining bright crimson, the thalline margin also but more slowly; epithecium subgranulose, yellow; thecium colorless, with iodine deep blue, the yellow epithecium purple; hypothecium colorless; paraphyses loosely coherent, with globular heads, jointed and some furcate above; hypothecium colorless; asci clavate; spores 8, ellipsoid, 13 to 16  $\mu$  long, 7 to 8  $\mu$  thick, polari-bilocular, the isthmus very faint, in some spores invisible.

Frequent on various barks, less often on stone.

4. *Caloplaca gilva* (Hoffm.) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 228. 1907.

*Verrucaria gilva* Hoffm. Deutschl. Fl. 2: 98. 1795.

Thallus indeterminate, ash gray, granular to verrucose, KHO+ crimson; apothecia adnate-sessile, small, 0.2 to 0.5 mm. wide; disk flat, orange; thalline margin thin, entire, persistent, yellow to light orange, with KHO like the disk; epithecium a thin yellow line, subgranulose; thecium colorless; paraphyses loosely coherent, the heads globular; hypothecium colorless; apothecia clavate; spores 8, ellipsoid, 13 to 16  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine, except heads of paraphyses remaining unchanged, staining blue with iodine.

Frequent on barks. Santa Cruz Peninsula, Herre. Cosmopolitan.

5. *Caloplaca citrina* (Hoffm.) T. Fries.

Thallus sordid yellowish, granulose, effuse, forming a coarsely rimose crust, KHO+ purplish; apothecia adnate-sessile, small, crowded; disk soon convex, yellowish to orange; thalline margin thin, crenulate, later almost obsolete; epithecium subgranulose, rich yellow; thecium colorless, with iodine violet blue; paraphyses coherent, jointed, not branched, their heads globular; asci inflated-clavate; spores 8, ellipsoid, polari-locular, no isthmus seen, 14 to 18  $\mu$  long, 7 to 8  $\mu$  thick.

On argillaceous boulders, Santa Monica Range.

6. *Caloplaca microphyllina* (Tuck.).

*Placodium microphyllum* Tuck. Syn. N. Amer. Lich. 1: 174. 1882.

Has been reported from Southern California, but authentic specimens are not available for description.

7. *Caloplaca fulgens* (Swartz) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 228. 1907.

*Lichen fulgens* Swartz, Nov. Act. Soc. Sci. Upsal. 4: 246. 1794.

Thallus pale yellowish, mealy, forming small monophyllous or submonophyllous patches, from 1 to 2 cm. wide, closely adherent to substratum, rugulose in the center, imbricate-lobate at the periphery, the border of the lobes at times yellowish-suffused, KHO+ purplish; apothecia sessile, single or two in a patch; disk flat to convex, rusty red to rusty orange; thalline margin crenately interrupted, finally obsolete; epithecium subgranulose, deep or dark yellow; thecium colorless, 60 to 80  $\mu$  high, this and the epithecium with iodine deep blue; paraphyses adglutinated, some barely clavate at the tips; hypothecium yellowish or milky; asci clavate; spores narrowly ellipsoid, 9 to 13  $\mu$  long, 3 to 4.5  $\mu$  thick, straight or lightly curved, simple or faintly bilocular.

On earth near Palm Springs at 140 meters above sea level. Western and northern North America; Europe; Africa (Algiers); New Zealand.

8. *Caloplaca cirrochroa* (Ach.) T. Fries.

Thallus suborbicular, thin, adnate, citrine yellow, the radiating lobes of the circumference not contiguous, short, not well developed, the larger part of the thallus, the central, an areolate, sorediate crust, KHO+ purple; apothecia not seen.

Occasional in the Santa Monica Range, on sandstone.

9. *Caloplaca bolacina* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 233. 1910.

*Placodium bolacinum* Tuck. Lich. Calif. 18. 1866.



Crust composed of turgid, scattered or contiguous, round squamules, angular and difform from juxtaposition, KHO+ dark crimson; apothecia sessile, 0.5 to .5 mm. wide; disk of the color of the thallus or orange, concave to finally lightly convex, undulate and at times umbilicately depressed in the center, KHO+ deep orange; proper margin paler than the disk; thalline margin obscure but perceptible under the rim of the apothecium; epithecium subcontinuous, yellowish orange; thecium colorless, 76 to 80  $\mu$  high, with iodine blue, but the epithecium not changed; paraphyses loosely coherent, clavate with round, yellow orange heads; hypothecium colorless, milky; asci clavate and subinflated-clavate; spores 8, oblong, bluntly ellipsoid, 13 to 16  $\mu$  long, 5 to 6  $\mu$  thick, polari-bilocular with an isthmus; hymenial gelatine with KHO crimson; spermatia 2 to 4  $\mu$  long, less than 1  $\mu$  thick.

On sandstone and clay. Common on plains and in the foothills.

#### 10. *Caloplaca murorum* (Hoffm.) T. Fries.

Crust from vitelline yellow to orange, orbicular, closely appressed, rimose-verruculose in the center, toward the circumference radiately lobed, the radii contiguous, the peripheral border crenate-lobed, flattening, dilated and paler in color; upper surface of thallus with KHO purple, the lower surface not stained; apothecia crowded in central part, sessile, 0.25 to 1 mm. wide; disk concolorous with the thallus, flat; thalline margin thin, entire, persistent; epithecium granulose, orange yellow; thecium colorless, 80  $\mu$  high; paraphyses laxly coherent, the globose, yellow tips with several jointed enlargements beneath, some paraphyses furcate under the tips; asci clavate, the membrane thickened at the top; spores 8, ellipsoid, 11 to 13  $\mu$  long, 4 to 7  $\mu$  thick, polari-bilocular; hymenial gelatine blue with iodine.

Frequent. On various rocks, from the foothills ascending the mountains to about 1,500 meters; Santa Catalina Island. Widespread from the northern United States to arctic America; Africa and Europe.

With us the forma *miniata* (Hoffm.) T. Fries of authors, with dark orange thallus prevails, the typical plant, with vitelline yellow thallus being rare.

#### 11. *Caloplaca elegans* (Link) T. Fries.

Thallus orbicular, the color a dark orange approaching vermilion, loosely appressed to rugulose-turgid, the discrete radiating laciniae lobate-crenate at the periphery, the center confusedly verrucose, KHO+ purple; apothecia sessile, the size of those of *C. murorum*; disk from flat to planoconvex, concolorous with the thallus; thalline margin thin, entire, at last almost disappearing, KHO+ purple; epithecium subcontinuous, rich yellow; thecium 64 to 68  $\mu$  high, colorless, in places yellow streaked from the epithecium; paraphyses strict, coherent, clavate above, septate and surmounted by a faint yellowish head; hypothecium faint yellowish; asci inflated-clavate; spores 8, ellipsoid, 12 to 14  $\mu$  long, 5 to 7  $\mu$  thick, polari-bilocular, the isthmus faint or absent; thecium and epithecium deep violet blue with iodine; spermatia straight, less than 1  $\mu$  thick.

Crystalline rocks in the mountains above 1,500 meters, here taking the place of the preceding plant.

San Bernardino Mountains, *Parish*; in the San Gabriel and San Jacinto Ranges. Northern United States to the arctic regions; northern Asia; Abyssinia; Europe; New Zealand.

The color of the form *miniata* of *C. murorum* is so similar to that of the present species that a first glance may be deceiving.

#### 12. *Caloplaca pellodella* (Nyl.).

*Lecanora pellodella* Nyl. Act. Soc. Sci. Fenn. 26: 29. 1899.

Thallus dark olive green, squamulose, forming small, irregularly orbiculate patches; disk of apothecia concolorous with the thallus; spores 8, 10 to 11  $\mu$  long, 5 to 6  $\mu$  thick, polari-bilocular; epithecium purplish with KHO.



On granite boulders near Elsinore, the type locality. Type deposited with Dr. W. Nylander in 1898; duplicates in herbarium of New York Botanical Garden and the U. S. National Herbarium.

The brief and insufficient description given is taken from Doctor Nylander's notes, the only source available to the author, who has no type specimen left and has not collected it since the year of its discovery, 1898.

**13. *Caloplaca coralloides*** (Tuck.) Zahlbr. Ann. Naturh. Hofmus. Wien **22**: 116. 1907.

*Placodium coralloides* Tuck. Proc. Amer. Acad. **6**: 287. 1864.

Thallus dwarfed, fruticulose, orange yellow or vitelline, terete-torulose, forking, decumbent to erect, 2 to 3 mm. high, KHO+ dark purple, as also the disk; apothecia pedicellate, the terminal sometimes clustered; disk flat, orange, the thalline margin entire, persistent; epithecium subcontinuous, grayish yellow; thecium colorless, 76 to 80  $\mu$  high; paraphyses loosely coherent, clavate and globular above, the heads of the same color with the epithecium, beneath the heads one or two joints; asci clavate, 66 to 72  $\mu$  long, 12  $\mu$  thick, the membrane thin throughout; spores 8, oblong-ellipsoid, 10 to 13  $\mu$  long, 3 to 4  $\mu$  thick, the loculi approximate without connecting tube (or isthmus); all hymenial structures blue with iodine and rose purple with KHO.

On sandstone cliffs at and above tidewater, Santa Catalina and San Clemente islands, *Trask*; at Newport and Del Mar on the mainland.

**14. *Caloplaca pollinii*** (Mass.) Jatta.

Thallus of minute, dispersed, gray granules to obsolete; apothecia small, adnate, not over 0.5 mm. wide, dull brown black, flat; epithecium granulose, pale brownish; thecium colorless; paraphyses loosely coherent, their tips globular, surmounting one or two enlargements; hypothecium colorless; asci clavate or oblong; spores 8, oblong-ellipsoid, colorless, polari-locular with a faint connecting tube, becoming plainer after KHO, 12 to 17  $\mu$  long, 5 to 7  $\mu$  thick; all structures staining blue with iodine.

On dead wood at Eden Hot Springs, Riverside County.

The mature apothecia are biatorine in aspect, but those of a junior state have a thin and inconspicuous yet distinguishable thalline margin.

## TELOSCHISTACEAE.

Thallus foliaceous or fruticulose; apothecia sessile, marginal or terminal; spores 8, colorless, polari-bilocular or quadrilocular; sterigma endobasidial, jointed; spermatia short, straight; gonidia Protococcus.

### KEY TO GENERA.

- Thallus foliaceous, horizontal-spreading or ascendent... XANTHORIA (p. 116).  
Thallus fruticulose, ascending to erect..... TELOSCHISTES (p. 117).

### XANTHORIA T. Fries.

The foliaceous thallus horizontally spreading or ascending, affixed to the substratum by rhizoids; apothecia circular, sessile or adnate, lecanorine; spores 8, polari-bilocular; sterigma endobasidial; spermatia short, oblong-ellipsoid.

### KEY TO SPECIES.

- Apothecia rare; thallus erect, the lobes short, finely lacerate  
above..... 1a. *X. lychnea pygmaea*.  
Apothecia more or less common.  
Apothecia numerous; thallus lobes laciniate..... 1c. *X. lychnea polycarpa*.  
Apothecia less numerous.  
Thallus lobes laciniate, suberect..... 1. *X. lychnea*.  
Thallus lobes laciniately dissected into linear divisions..... 1b. *X. lychnea laciniosa*.



**1. *Xanthoria lychnea* (Ach.) T. Fries.**

Thallus yellow to orange, ascending, the lobes compound, laciniately divided, crowded, effusely spreading or in orbicular patches,  $\text{KHO} +$  purple,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, not frequent; disk concolorous with the thallus, concave, with an entire, permanent thalline margin somewhat paler than the thallus; epithecium subcontinuous, yellow; thecium colorless, 100 to 108  $\mu$  high; paraphyses stout, septate, some forked below the globular yellow apices; hypothecium colorless, overlying a thick gonidial layer; asci subinflated-clavate, the membrane thickened at the top; spores 8, oblong-ellipsoid, 12 to 20  $\mu$  long, 6 to 10  $\mu$  thick, polari-bilocular with a very faint connecting isthmus; hymenial gelatine with iodine blue, the thickened tops of the asci dark blue, the paraphyses not stained.

On various barks and dead wood; frequents lower altitudes. Throughout the United States; North and South America; Europe.

**1a. *Xanthoria lychnea pygmaea* (Bory) Herre, Proc. Washington Acad. Sci. 12: 236. 1910.**

*Borrera pygmaea* Bory; Fries, Lich. Eur. Ref. 73. 1831.

Thallus effusely spreading or pulvinate, orange color, the minute irregularly cleft lobes with finely lacerate or crenate border; apothecia rare.

A form of the Pacific coast; San Clemente Island on bleached bones, *Trask*; on sandstone near Newport, Orange County.

**1b. *Xanthoria lychnea laciniosa* (Dufour) Herre, Proc. Washington Acad. Sci. 12: 235. 1910.**

*Parmelia parietina laciniosa* Dufour; Fries, Lich. Eur. Ref. 73. 1831.

The pulvinate-orbicular, orange-colored thallus laciniately dissected into linear divisions, freely fruiting.

Frequent on barks in the Santa Monica Range. Throughout the United States; Europe.

**1c. *Xanthoria lychnea polycarpa* (Ehrh.) T. Fries.**

Thallus similar to that of the species, but not so well developed, orbicular-pulvinate, much and deeply cleft; apothecia numerous, often covering the thallus in the center.

Barks, fences, and dead wood, throughout our district. North America and Europe.

**TELOSCHISTES Norm.**

Thallus fruticulose, decumbent or erect, branching, terete or compressed-terete; apothecia sessile, lecanorine, marginal or lateral; spores 8, colorless, polari-bilocular (in our species); spermatia short, straight; sterigma endobasidial, jointed.

**KEY TO SPECIES.**

Thallus erect, terete, smooth..... 2. *T. flavicans*.

Thallus not terete.

Minutely hispid, compressed, canaliculate..... 3. *T. villosus*.

Not hispid, compressed, flat..... 1. *T. chrysophthalmus*.

**1. *Teloschistes chrysophthalmus* (L.) T. Fries.**

Fruticulose, erect, compressed, linear-laciniate, greenish grayish to yellowish orange; apothecia subterminal and terminal; disk dark orange, thalline margin and the thallus fringed with fibrillae; epithecium yellow, subgranulose; thecium colorless, 100  $\mu$  high; paraphyses strict, compacted, septate and slightly thickened at the tips; hypothecium colorless; asci clavate; spores 8, broadly ellipsoid, polari-bilocular with a connecting tube or isthmus, 13 to 17  $\mu$  long, 8 to 11  $\mu$  thick; epithecium with  $\text{KHO} +$  purple, but neither thallus nor disk stained by this reagent.

On shrubs or branches of trees. Throughout the United States; Lower California, *Orcutt*; Santa Catalina Island. Cosmopolitan.



**2. *Teloschistes flavicans* (Swartz) Norm.**

Fruticulose, erect, terete or slightly compressed, branching, often intricately so, thallus smooth or with the apothecia fringed with fibrils and beset with soredia, apothecia usually subterminal (freely fruiting with us), disk flat to lightly convex the thalline margin thin, crenulate or entire, at last obscure; epithecium yellow, subgranulose, thin but better defined than in *T. chrysophthalmus*; thecium colorless, 84 to 88  $\mu$  high; paraphyses coherent, septate; hypothecium colorless; asci clavate; spores 8, ellipsoid, polar-bilocular with a connecting tube, 10 to 20  $\mu$  long, 6 to 12  $\mu$  thick; thallus and disk with KHO purple,  $\text{Ca}(\text{ClO})_2$ —.

A conspicuous and handsome lichen on shrubs and branchlets frequent in our district. Widely distributed through the warmer regions.

**3. *Teloschistes villosus* (Ach.) Norm.**

Thallus fruticulose, erect or suberect, pale gray, compressed-canaliculate, minutely hispid with short white bristly hairs on the dorsal surface, the attenuate-laciniate, linear ultimate ramifications subterete; apothecia few, subterminal; disk concave, yellowish red, the thalline margin thin, obscure; epithecium finely granulose, yellow; thecium colorless 56  $\mu$  high; paraphyses free, branched, septate, capitate at the slightly colored tips; hypothecium colorless; asci clavate; spores 8, oblong-ellipsoid, 11 to 14  $\mu$  long, 4.5 to 6  $\mu$  thick; hymenial gelatine with iodine blue, the asci darkest at the top, KHO staining the epithecium and heads of the paraphyses a carmine red, the disk also, but the thallus not affected.

On living and dead shrubs, Lower California, *Orcutt*; Point Loma near San Diego, on *Lycium californicum*; near Newport, Orange County, and as far north as Santa Cruz Island, off Santa Barbara, where it was collected by Mrs. Blanche Trask.

**BUELLIACEAE.**

The crustaceous thallus varying from uniform to squamulose, often becoming radiately lobed at the periphery; apothecia round, embedded in or sessile upon the thallus; spores mostly 8, colored, bilocular to quadrilocular or submuriform; sterigma jointed; spermatia short, straight.

**KEY TO GENERA.**

- Apothecia lecideine..... **BUELLIA** (p. 118).  
 Apothecia lecanorine..... **RINODINA** (p. 123).

**BUELLIA** De Not.

Thallus uniform to squamulose, a radiating lobation less pronounced than in the following genus; gonidia *Protococcus*; apothecia round, immersed, adnate or sessile; disk dark, blackish, with a dark, often horny hypothecium; spores as stated.

**KEY TO SPECIES.**

Thallus more or less lobed at periphery.

Substratum earth; thallus pale ash color..... 4. *B. bolacina*.

Substratum rock (*B. alboatra* occasionally on bark).

Thallus well developed.

Light colored.

Yellowish..... 3. *B. lepidastr*.

White, mealy..... 1. *B. rinodinoidea*.

Dark olive green to brown.

Lobed at periphery..... 6. *B. badia*.

Not lobed at periphery..... 5. *B. pullata*.

Thallus not well developed, whitish, the loba-

tion indistinct..... 2. *B. alboatra*.



Thallus not lobed at periphery.

Substratum rock.

Thallus granular, gray (occurring also on bark).... 9. *B. myriocarpa*.

Thallus not granular.

Squamulose, white; squamules dispersed..... 7. *B. retrovertens*.

Not squamulose.

Rimose-areolate, white..... 8. *B. stellulata*.

Effuse, whitish..... 2a. *B. alboatra ambigua*.

Substratum bark.

Thallus white.

Spores bilocular..... 13. *B. penichra*.

Spores quadrilocular..... 11. *B. triphragmia*.

Thallus not white.

Gray to greenish gray.

Coarsely granular to warty..... 10. *B. parasema*.

Less coarse, granular, smoother..... 10a. *B. parasema vulgata*.

Thallus yellow to greenish yellow.

On rock, rimose-areolate..... 14. *B. halonia*.

On bark, squamulose..... 12. *B. oidalea*.

### 1. *Buellia rinodinoides* Anzi.

Thallus white, farinaceous, coarsely and distinctly rimose-areolate; areolae flat to turgid, round-angular and sinuous, with KHO tardily sordid orange,  $\text{Ca}(\text{ClO})_2$ —; apothecia black, naked, innate and flat to adnate and convex, the proper margin thin, concolorate and finally disappearing; epithecium subgranulose, fuliginous blackish; thecium colorless, 88 to 90  $\mu$  high, with iodine blue; paraphyses loosely coherent, simple, not jointed, the fuliginous tips clavate; hypothecium fuscous; asci clavate; spores blunt-ellipsoid, brownish gray, bilocular, 9 to 16  $\mu$  long, 5 to 8  $\mu$  thick, not or barely constricted at the middle; epispore thin.

On disintegrated granite, Palm Springs, Riverside County; calcareous rocks on the beach at "White Point" near San Pedro. Found also in Japan and Europe.

### 2. *Buellia alboatra* (Hoffm.) T. Fries.

Thallus effuse or peripheral lobation indistinct, whitish, areolate-rimose and areolate-verrucose, KHO—,  $\text{Ca}(\text{ClO})_2$ —, farinaceous, poorly developed, mostly in small patches; apothecia sessile, generally several grouped; disk black or with a faint bloom, soon slightly convex, the thin, black proper margin persistent, entire; thecium colorless; paraphyses separate, jointed, somewhat gelatinous, with dark heads; asci clavate; hypothecium pale brown; spores 8, oblong-ellipsoid, 16 to 20  $\mu$  long, 7 to 10  $\mu$  thick, 4-locular, often a little curved, the epispore stout; hymenial gelatine blue with iodine; spermatia cylindric, straight.

On bark and rocks; bark of *Pseudotsuga* in the Tehachapi Mountains at 1,300 meters altitude; on rocks in the Santa Monica Range.

This is variety *saxicola* Fries of authors.

### 2a. *Buellia alboatra ambigua* (Ach.) T. Fries.

Thallus rimose-areolate, effigurate, thin with a blackish hypothalline border (at times absent); apothecia adnate; disk flat, often with a faint bloom and having a permanent, entire or crenulate, thickened thalline margin.

Frequent on slate schist in the Santa Monica Range.

Distinguished from the species by the thinner, effigurate thallus.

### 3. *Buellia lepidastr* Tuck.

Thallus squamulose-areolate, pale yellowish or sordid buff, the flat, soon convex, coarse squamules becoming lobate at the circumference, KHO+ yellow,  $\text{Ca}(\text{ClO})_2$ —; hypothallus black; apothecia sessile, 0.25 to 1 mm. wide; disk convex with a thin,



entire margin, this finally disappearing; epithecium subcontinuous, dark brown; thecium  $64\ \mu$  high, sordid, with iodine blue; paraphyses loosely coherent, coarse, jointed, their heads black brown, globular; hypothecium dark brown; asci clavate and subinflated-clavate; spores 8, ovoid-ellipsoid, bilocular, brown,  $12$  to  $18\ \mu$  long,  $5$  to  $10\ \mu$  thick, slightly constricted; spermogones shown as small black depressions; spermatia rod-like, straight,  $8$  to  $12\ \mu$  long and somewhat over  $1\ \mu$  thick, with acuminate ends.

On siliceous and calcareous rocks in the Santa Monica Range; near Elsinore and elsewhere in southern California. Found also in the northern, southern, and eastern United States.

#### 4. *Buellia bolacina* Tuck.

"Thallus of scattered, turgid, wavy and plicate, glebous squamules ( $1$  to  $2$  mm. wide), from greenish glaucescent at length white; apothecia small (scarcely reaching  $1$  mm. in width), adnate, planoconvex, opaque, subimmarginate, the margin soon disappearing, the hypothecium blackening; spores ellipsoid, bilocular,  $12$  to  $20\ \mu$  long by  $6$  to  $10\ \mu$  thick. The well-developed paraphyses loose and brown-headed."

On the earth in mesas, San Diego, *Cooper*; in the same habitat, Lower California, *Orcutt*.

Authentic specimens not having been seen, the above description is copied from Tuckerman.

#### 5. *Buellia pullata* Tuck.

Thallus rimose-areolate or of dispersed "dark olivaceous brown" and blackening, flat squamules; apothecia adnate, small, not over  $0.5$  mm. wide; disk black, flat with a concolorous, thin, rather indistinct proper margin; epithecium subcontinuous, brown black; thecium  $80$  to  $88\ \mu$  high, colorless, stained handsome blue with iodine, but neither epithecium nor hypothecium affected by this reagent; paraphyses coherent, about  $3\ \mu$  thick, jointed, some thickened above and with brown black heads; hypothecium brown black like the epithecium; asci clavate and subinflated-clavate,  $48\ \mu$  long,  $16$  to  $18\ \mu$  thick; spores 8, ellipsoid, brown, bilocular,  $12$  to  $16\ \mu$  long,  $7$  to  $11\ \mu$  thick, little or not at all constricted, the loculi with a bluish gray center.

On trap rock, Topanga Canyon, Santa Monica Range, at  $230$  meters altitude. Reported also from the vicinity of San Francisco by Dr. A. C. Herre.

#### 6. *Buellia badia* (Fries) Koerb.

Thallus dark olivaceous brown, rimose and squamulose, the squamules flat, rugulose, lobate-crenate; apothecia innate and adnate-sessile, from  $0.5$  to  $1$  mm. wide, often two or several grouped; disk black, flat to convex, the proper margin thin, entire, black, finally almost disappearing; epithecium brown, granulose; thecium  $60\ \mu$  high, light brown; paraphyses separate, slender, with brown, abruptly capitate tips; hypothecium light to dark brown; asci inflated-clavate; spores  $12$  to  $14\ \mu$  long,  $7$  to  $8\ \mu$  thick, obtuse-ellipsoid, bilocular, constricted; hymenial gelatine with iodine blue.

On sandstone and crystalline rocks. Foothills of the San Gabriel Mountains near Sierra Madre, Los Angeles County; running over mosses on boulders in the Yosemite Valley. Reported from Kansas, but principally west of the Rocky Mountains from Washington southward.

#### 7. *Buellia retrovertens* Tuck.

Thallus whitish, convex, round or sublobulate areoles, scattered or loosely aggregated,  $\text{KHO}+$  greenish yellow,  $\text{Ca}(\text{ClO})_2-$ ; apothecia adnate-sessile,  $0.25$  to  $1$  mm. wide; disk black, at first flat with a thin erect margin, later convex and immarginate; epithecium brown black, subgranulose; thecium colorless, partly light brownish,  $60\ \mu$  high, with iodine blue then sordid blue; paraphyses coherent, not distinct, with brownish capitate tips; hypothecium pale brown; asci clavate, rounded at top,  $45$



to 50  $\mu$  long, 12  $\mu$  thick; spores smoky gray to brown, 11 to 16  $\mu$  long, 7 to 8  $\mu$  thick, ellipsoid, the septum and epispore thick, not constricted, slightly paler at center of each locus.

On trap rock, Topanga Canyon, Santa Monica Range; at Del Mar on quartz; head of Bright Angel Trail, Grand Canyon, Arizona. From the Rocky Mountain Region westward.

**8. *Buellia stellulata* (Taylor) Mudd.**

Thallus whitish, thin, forming a finely rimose-areolate crust, the areoles flat or lightly convex, with a black encircling hypothallus; apothecia very small, scarcely 0.5 mm. in width; disk black, flat with a black proper margin, becoming immarginate; epithecium subcontinuous, brown; paraphyses loose, septate, brown capitate; hypothecium lighter brown than the epithecium; asci clavate; thecium blue with iodine, about 72  $\mu$  high; spores ellipsoid, both ends obtuse, bilocular, slightly constricted, 10 to 12  $\mu$  long, 4 to 5  $\mu$  thick, smoky gray to brown; medulla not stained by iodine.

On rocks: San Diego, *Orcutt*; Santa Monica Range and northward. Distributed through the eastern United States; cosmopolitan.

**9. *Buellia myriocarpa* (Lam. & DC.) Mudd.**

Thallus whitish, gray to grayish green, thin, indeterminate, pulverulent, or obsolete; apothecia small, about 0.25 mm. wide; disk flat, becoming convex, black, the proper margin concolorous, thin, soon obsolete; epithecium brownish black; thecium colorless, 44 to 48  $\mu$  high; paraphyses strict with brown, capitate tips; hypothecium brown black; asci clavate; spores 8, oblong-ellipsoid, smoky gray to brown, not constricted, bilocular, 12 to 16  $\mu$  long, 4 to 8  $\mu$  thick; sterigma branched, articulate, spermatia staff-shaped and narrow-fusiform, tapering at each end, 4 to 8  $\mu$  long, slightly exceeding 1  $\mu$  in thickness.

Common on barks, wood, and stones. It varies somewhat as to thallus and size of apothecia, hence several forms are described of which we have: *Forma punctiformis* (Hoffm.) Mudd, with the thallus indistinct, light gray, the apothecia minute—on siliceous pebbles and conglomerate, Cahuenga Pass, Santa Monica Range; *forma chloropolia* (Fries) T. Fries, with the thallus granulose, dark gray when dry, greenish when moistened, the apothecia very minute—on bark of *Cercocarpus betulaeifolius*, Santa Monica Range; and *forma ecrustacea* Leight., the thallus absent, the apothecia small—on trap rock, Topanga Canyon, Santa Monica Range.

**10. *Buellia parasema* (Ach.) Koerb.**

Thallus light gray or with a faint yellowish tint, minutely squamulose, "chinky," surrounded by a thin, black hypothalline border, KHO+ citrine yellow, then gradually greenish; apothecia sessile, from 0.25 to 1 mm. wide; disk black, flat to convex, the thin, black proper margin finally disappearing; epithecium subgranulose, brown, thin; thecium 56 to 76  $\mu$  high, colorless or in places light brownish rays extending upward from the hypothecium; paraphyses clavate with a brownish capitate top and jointed above; hypothecium dark brown, thick; asci inflated-clavate; spores 8, ellipsoid-oblong, brown, bilocular, 16 to 20  $\mu$  long, 6 to 8.5  $\mu$  thick, with a smoky grayish spot in each locus, but in fully matured spores the loculi uniform brown, the spores slightly or not constricted, straight or somewhat obliquely curved; spermatia straight, narrowly fusiform, 4 to 8  $\mu$  long, about 1  $\mu$  thick.

On various smooth barks and dead wood. A common, cosmopolitan species and quite variable, but of the forms of authors only the following variety has been found with us:

**10a. *Buellia parasema vulgata* T. Fries.**

Described as having a smoother thallus, the black hypothalline border indistinct or wanting; apothecia small, punctiform, barely 0.5 mm. wide, epithecium sub-



granulose, brown, the color mostly due to the colored heads of the paraphyses; thecium 64 to 68  $\mu$  high, colorless; paraphyses laxly coherent; hypothecium fuscous; asc-clavate or subinflated-clavate; spores 8, 12 to 17  $\mu$  long, 5 to 5.5  $\mu$  thick.

On smooth bark of *Quercus agrifolia* in the Santa Monica Range.

**11. Buellia triphragmia** (Nyl.).

*Lecidea triphragmia* Nyl. Mém. Soc. Sci. Nat. Cherbourg 5: 126. 1857.

Epithecium subcontinuous, dark brown, gradually paling downward; thecium pale yellowish brownish, 84 to 88  $\mu$  high; paraphyses coherent, slightly clavate at the brown tips; hypothecium dark blackish brown; asci inflated-clavate; spores 8, oblong-ellipsoid, 19 to 24  $\mu$  long, 8 to 11  $\mu$  thick, 4-locular, the immature, colorless spores seen to be bilocular, otherwise but few bilocular ones present.

On bark of *Pseudotsuga macrocarpa* and dead wood in the San Gabriel Range; Mount Wilson, at 1,550 meters altitude.

**12. Buellia oidalea** Tuck.

Thallus pale yellow with a greenish tinge, verruculose-rimose, glaucescent, KHO+ greenish yellow, Ca(ClO)<sub>2</sub>—, limited by a black hypothallus; apothecia minute, 0.2 to 1.75 mm. wide, immersed, later sessile; disk black, soon convex, the at first entire proper margin crenulate; epithecium continuous, brown, paling downward; thecium colorless, 140  $\mu$  high, with iodine blue; paraphyses loosely coherent, the tips slightly capitate, some forked below the tips, not colored; hypothecium brown like the epithecium, 100 to 108  $\mu$  high; asci inflated-clavate, the membrane thickened at upper part (20  $\mu$  thick); spores ellipsoid and oblong-ellipsoid, varying from 1 to 6 in a spore sack, 28 to 68  $\mu$  long, 16 to 24  $\mu$  thick, muriform, with 7 septa in the transverse diameter and several in the longitudinal axis, the spores varying from colorless to gray and finally brown.

On various barks. On bark of the Torrey pine, San Nicolas Island, *Trask*; bark of shrubs, Santa Catalina Island, *Trask, Baker*; on *Adenostoma fasciculatum* at Point Loma, near San Diego.

**13. Buellia penichra** (Tuck.).

*Buellia oidalea penichra* Tuck. Syn. N. Amer. Lich. 2: 99. 1888.

Thallus white, smooth or slightly rugulose, becoming chinky, KHO—, Ca(ClO)<sub>2</sub>—, occurring in small patches limited by a black hypothalline border; apothecia sessile, 0.25 to 1 mm. wide; disk dull black, flat, with a turgid, black, entire, somewhat glistening proper margin, later subimmarginate; epithecium subgranulose, brown; thecium colorless, 100  $\mu$  high; paraphyses loosely coherent; hypothecium yellowish brown, a little paler than the epithecium; asci inflated-clavate, nearly as high as the thecium; spores 6 to 8, bluntly ellipsoid, 14 to 28  $\mu$  long, 7 to 14  $\mu$  thick, submuriform, with 4 or 5 transverse septa and several in the longitudinal axis.

On bark of *Pseudotsuga macrocarpa*, Mount Wilson, Los Angeles County, at 1,500 meters altitude.

**14. Buellia halonia** (Ach.) Tuck.

Thallus uniform, greenish yellow, rimose-areolate, the areoles smooth, flat, angular, encircled by a black hypothalline border, KHO+ pale yellow, Ca(ClO)<sub>2</sub>+ orange; apothecia black, opaque, sessile; disk flat, at last convex, the margin permanent, concolorous, entire or crenulate-angulose; epithecium subgranulose, brown; thecium colorless, 72  $\mu$  high; paraphyses loosely coherent, simple, some brown-capitate above; hypothecium rather more than half the height of the thecium and a little paler than the epithecium, gradually paling upward, horny; asci inflated-clavate, 70  $\mu$  long, 16  $\mu$  thick; spores ellipsoid, both ends blunt, bilocular, brown when mature, 13 to 16  $\mu$  long, 6 to 8  $\mu$  thick; hymenial gelatine with iodine intense blue; spermatogones not seen.

On calcareous rocks, Santa Catalina Island.



**RINODINA** (Ach.) S. F. Gray.

Thallus uniform or effigurate and lobed at the periphery, destitute of rhizinæ; apothecia lecanorine, the disk dark; spores commonly bilocular, rarely 4-locular; sterigma short, straight.

## KEY TO SPECIES.

Substratum mineral.

Substratum rock.

Thallus not lobed at periphery, light gray..... 7. *R. confragosa*.

Thallus lobed at periphery.

Densely pruinose throughout..... 1b. *R. radiata lactea*.

Not densely pruinose.

Red brown to brown..... 4. *R. thysanota*.

Lighter colored.

Yellowish..... 2. *R. oreina*.

Not yellowish.

Whitish to gray.

Conspicuously radiate-lobed at the periphery..... 1. *R. radiata*.

Depauperate; radiate lobation

lost..... 1a. *R. radiata fimbriata*.

Sordid buff..... 3. *R. angelica*.

Substratum earth; thallus not lobed at periphery, uniform, dark.

Spores 2-locular..... 5. *R. turfacea*.

Spores becoming 4-locular..... 6. *R. conradi*.

Substratum vegetable, bark or wood.

Thallus brown, rimose..... 11. *R. hallii*.

Thallus of some shade of gray.

Dull greenish gray..... 10. *R. succedens*.

Of an ordinary gray.

Thallus staining yellow with iodine..... 12. *R. roboris*.

Not staining yellow.

Thallus effusely granular-areolate..... 8. *R. sophodes*.

Reduced, almost obsolete (occurring also on rock)..... 9. *R. exigua*.

**1. Rinodina radiata** Tuck.

Thallus whitish gray to gray, closely appressed, orbicular, in the center rimose-areolate, the periphery radiate-lobed, the radii flattening, somewhat dilated and lobulate at the border, KHO—, Ca(ClO)<sub>2</sub>—, the medulla with iodine—, a more or less distinct, black hypothallus encircling the thallus; apothecia crowded in the center, innate then adnate, scarcely exceeding 0.8 mm. in width; disk flat then convex, often subpruinose, the thalline margin persistent, entire; epithecium subgranulose, yellowish grayish; thecium colorless, 84 to 88  $\mu$  high, sometimes brownish tinged; paraphyses coherent, with brown tips, septate; hypothecium brown; asci clavate, the membrane thickened at top; spores ovoid-ellipsoid, constricted, brown, bilocular, 10 to 13  $\mu$  long, 6 to 7  $\mu$  thick; spermogones designated by minute, black, funnelform depressions, their contents staining yellow with iodine; sterigma simple, straight, inverted club-shaped; spermatia short, straight, 8 to 12  $\mu$  long, less than 1  $\mu$  thick; thecium with the epithecium and hypothecium deep blue with iodine.

On various rocks throughout the district; a Pacific Coast lichen.



**1a. *Rinodina radiata fimbriata* Tuck.**

"Thallus depauperate," without the peripheral radiation, the limiting black hypothallus distinct.

With the species but less frequent.

**1b. *Rinodina radiata lactea* subsp. nov.**

Thallus appressed, white, orbicular, pulverulent, rimose-areolate in the center, radiate-lobate at the periphery, the radiating lobes contiguous, flattened and slightly dilated outward, with an entire or subcrenulate border; hypothallus black, not distinct, KHO—, Ca(ClO)<sub>2</sub>—, the medulla with iodine—; apothecia innate to adnate, crowded in the center, 0.25 to 1.25 mm. wide; disk flat to at last convex, dull black, permanently densely white pruinose; thalline margin permanent, mostly thin; epithecium granulose, pale dingy yellowish; thecium colorless, 60  $\mu$  high, deep blue with iodine, including the epithecium; paraphyses coherent, strict, scarcely clavate at the tips, indistinctly septate; hypothecium brown, darker than the epithecium; asci clavate, the membrane thickened above; spores 8, 9 to 15  $\mu$  long, 4 to 8  $\mu$  thick, blunt-ellipsoid, bilocular, brown, constricted, the epispore thin; sterigma narrowly inverted-clavate, very indistinctly jointed; spermatia short, straight, 6 to 8  $\mu$  long, 1 to 1.5  $\mu$  thick; spermogones indicated by minute black dots.

On calcareous and argillaceous rocks in the vicinity of the ocean. The type is from Santa Catalina Island, but the same is found also at Newport along the beach bluffs.

Type deposited with Dr. A. C. Herre; duplicate in herb. Hasse.

**2. *Rinodina oreina* (Ach.) Mass.**

Crustaceous, pale sulphur color, closely appressed, the center rimose-areolate, becoming radiately lobed at the periphery, often blackish-suffused, giving the whole plant a dark appearance; apothecia innate, emerging to adnate, 0.5 to 1 mm. wide; disk black, at last slightly convex; thalline margin entire; paraphyses coherent; asci clavate; spores 8, round-ellipsoid, bilocular, brown, 9 to 12  $\mu$  long, 5 to 8  $\mu$  thick, little or not at all constricted, the epispore thin.

Not infrequent in the mountains above 1,500 meters. On quartzose rocks in the San Gabriel, San Bernardino, and San Jacinto Ranges. Occurs in the northern and western United States and in Europe.

**3. *Rinodina angelica* Stizenb.; Hasse, Bull. Torrey Club 24: 447. 1897.**

Thallus crustaceous, rimose-areolate, or squamous, becoming lobate at the circumference, the squamules contiguous, light grayish flesh color, the fertile ones subverrucose, prominent, KHO + greenish yellow soon crimson, Ca(ClO)<sub>2</sub>—; apothecia innate to adnate; disk flat, occasionally emerging to planoconvex, 0.25 to 1 mm. wide, dull black or with a faint bloom; thalline margin persistent, in well-developed specimens turgid, entire or crenulate; epithecium granulose, yellowish brown; thecium 120 to 128  $\mu$  high; paraphyses subcoherent, with round, colored heads or but slightly clavate and not colored above, indistinctly jointed, not forked; hypothecium colorless or nearly so; asci inflated-clavate to ventricose, the membrane thickened at top; spores 8, brown, bilocular, 16 to 26  $\mu$  long, 8 to 12  $\mu$  thick, the spots of the loculi obcordate with an isthmus; epithecium and hypothecium with KHO + orange and the thecium yellowish orange; spermatia 4 to 6  $\mu$  long and less than 1  $\mu$  thick, straight.

On rocks. Type locality, foothills of the Santa Monica Range near the Soldiers' Home. It is frequent in the Santa Monica Range and southward, but has not been found above about 1,500 meters; Santa Catalina Island.

Type deposited in the Herbarium of the New York Botanical Garden; duplicates in the U. S. National Herbarium, with Dr. A. C. Herre, and in herb. Hasse.

**4. *Rinodina thysanota* Tuck.**

Thallus crustaceous, closely affixed, forming round patches 5 mm. wide and by aggregation increasing to several centimeters, in color sienna brown or somewhat



lighter, irregularly rimose in the center and radiate at the periphery, the linear, narrow, contiguous radii forked or crenate and slightly dilated at the extremities, occasionally the peripheral ends whitish pruinose; apothecia rarely seen, small, not over 0.25 mm. wide, the disk plane, brown black with a thin, persistent thalline margin; epithecium subgranulose, brown; thecium  $88\ \mu$  high; paraphyses loose, thick, with 2 or 3 septa, the internodes a little enlarged, the apices grayish brown; hypothecium of the color of the thallus; asci 48 to  $52\ \mu$  long, 20 to  $24\ \mu$  thick, the membrane thickened above; spores 8, ovoid and blunt-ellipsoid, brown, bilocular, 14 to  $17\ \mu$  long, 7 to  $10\ \mu$  thick, a round spot in each loculus, with iodine a handsome blue, no change with KHO.

On micaceous rock in the San Gabriel Mountains and on trap in Topanga Canyon of the Santa Monica Range.

In the higher mountains of our district a *Rinodina* occurs having the thallus of the color of this species or darker, but in general form and size conforming with *Rinodina radiata*, the disk at first punctate, immersed, later similar to that of *R. radiata*, but unlike both *thysanota* and *radiata*, neither disk nor thallus ever found pruinose.

##### 5. *Rinodina turfacea* (Wahl.) T. Fries.

Crustaceous, verruculose or indeterminate, pale brownish ash color, KHO—,  $\text{Ca}(\text{ClO})_2$ —, the hypothallus indistinct; apothecia crowded in groups, adnate-sessile, 0.25 to 1 mm. wide; disk planoconvex, black; thalline margin persistent, thin, entire or crenulate; epithecium subcontinuous, yellowish brown; thecium colorless, 100 to  $124\ \mu$  high; paraphyses loose, the tips clavate and brownish; hypothecium pale yellowish tinted; asci inflated-clavate; spores 8, oblong-ellipsoid, bilocular, not at all or barely constricted, 16 to  $36\ \mu$  long, 8 to  $16\ \mu$  thick, with an obcordate spot in each loculus, the mature spores reddish brown, the spots of a light gray shade.

On earth and decaying roots; Santa Catalina Island on the latter substratum; on earth at Point Loma; on earth in crevices of rocks, Santa Monica Mountains in Topanga Canyon and Cahuenga Pass.

Our plant is the forma *nuda* T. Fries. The disk is naked, distinguishing it from the forma *roscida* (Sommerf.) T. Fries, which has a pruinose disk and has not as yet been found with us. The forma *minaraea* Nyl. (*R. minaraea* (Ach.) T. Fries) is much the same, the thallus uniform, the apothecia sessile, the disk strongly convex, reddish black and black, excluding the thalline margin. It is found on earth in the Santa Monica Range.

##### 6. *Rinodina conradi* Koerb.

Thallus uniform, rugulose-verrucose, sordid yellowish gray, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia at times quite numerous, sessile, 0.5 to 0.8 mm. wide; disk flat to planoconvex, brown blackish; thalline margin turgid, persistent, entire to crenulate; epithecium grayish yellow with a tinge of brown; thecium 116 to  $120\ \mu$  high, colorless, now and then a dash of pale straw color descending from the epithecium; paraphyses coherent, clavate at the colored tips, and after action of KHO seen jointed; hypothecium pale straw color, paler than the epithecium; asci inflated-clavate and ventricose; spores 8, reddish brown, 24 to  $31\ \mu$  long,  $12\ \mu$  thick, bilocular but by a secondary septation appearing 4-locular, epispore thin; hymenial structures stained blue with iodine.

On earth in the Santa Monica Range.

The thallus is similar in color to that of *R. angelica* Stizenb., but the latter is coarser, lobate at the periphery, and with the spores not so acuminate as those of *R. conradi*.

##### 7. *Rinodina confragosa* (Ach.) Koerb.

Crust whitish to ash-colored, thick, verrucose, the verrucæ becoming squamules and crenulate, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, reaching 1.25 mm. in width; disk flat, dark brownish black with a turgid, crenulate thalline margin; epi-



thecium subcontinuous, dark yellowish brown; thecium colorless, 76 to 80  $\mu$  high; paraphyses loosely coherent, the tips clavate and colored; asci inflated-clavate, 70 to 72  $\mu$  long, 20  $\mu$  thick, the membrane thickened at top; hypothecium pale yellowish; spores 8, brown, blunt-ellipsoid and oblong-ellipsoid, 18 to 24  $\mu$  long, 11 to 13  $\mu$  thick, barely or not at all constricted, some slightly curved, bilocular, brown, the lumina roundish, gray; hymenial gelatine blue with iodine.

On rocks in the Santa Monica Mountains. Widely distributed throughout North America.

**8. *Rinodina sophodes* (Ach.) T. Fries.**

Thallus dark grayish brown, granulate-areolate, interruptedly limited by a black hypothalline border, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia numerous, small, 0.35 to 0.5 mm. wide; disk plane and planoconvex, dull black with a thin crenulate lecanorine margin, later becoming almost obsolete; epithecium subcontinuous, sordid yellowish brown, pale to dark; thecium colorless, 100 to 108  $\mu$  high; paraphyses coherent, some with small brown heads; hypothecium sordid pale yellowish; asci inflated-clavate; spores 8, oblong-ellipsoid, brown, bilocular, 16 to 20  $\mu$  long, 8 to 10  $\mu$  thick, the epispore thick, the lumina oblong, gray, the spores mostly a little curved; all hymenial structures stained a handsome blue with iodine, no change with KHO.

On various barks, common throughout North America: it is found in Europe, North Africa, Asia, and Oceania.

**9. *Rinodina exigua* (Ach.) T. Fries.**

Thallus thin, whitish or ash-colored, effuse, granular, or disappearing; apothecia smaller than those of *R. sophodes*; epithecium brown, subgranulose; thecium 70 to 80  $\mu$  high, with iodine blue; paraphyses loosely coherent, the tips brownish-capitate; hypothecium pale yellowish; asci inflated-clavate; spores oblong-ellipsoid, brown, bilocular, 15 to 20  $\mu$  long, 8 to 9  $\mu$  thick; disk black, convex, the lecanorine margin white, entire.

With and as common as *R. sophodes*.

**10. *Rinodina succedens* Nyl.**

*Lecidea succedens* Nyl. Flora **49**: 372. 1866.

*Rinodina succedens* Nyl.; Macoun, Cat. Canad. Pl. 117. 1902.

Thallus dull greenish ash color, rugose-verrucose, indistinctly rimose, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.5 to not over 1 mm. wide; disk dull black, concave to flat; thalline margin persistent, turgid, entire, seldom slightly crenulate; epithecium subcontinuous, sordid pale yellowish ash color; thecium colorless, 136 to 140  $\mu$  high; paraphyses loosely coherent, slightly thickened and colored like the epithecium at the tips; hypothecium pale straw color; asci clavate and inflated-clavate; spores 8, 20 to 32  $\mu$  long, 11 to 16  $\mu$  thick, ovoid-ellipsoid, dark brown, bilocular, constricted, a round spot of paler brown without isthmus in each locus, the immature spores 26  $\mu$  long, 11  $\mu$  thick and colorless; iodine staining all hymenial structures blue; no change with potassium hydrate.

On bark of *Pseudotsuga macrocarpa* in our mountains from about 1,000 meters upward. Reported from Newfoundland by the late Rev. A. Waghorne.

**11. *Rinodina hallii* Tuck.**

Thallus effuse, ash color with a faint tint of light brown, more apparent when moist, rimose-areolate, the areolae concave with crenulate border, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, the thin lecanorine margin soon obsolete; disk dull black, convex, at first slightly pruinose; epithecium continuous, pale yellowish brown; thecium 124 to 128  $\mu$  high, with iodine deep blue, the epithecium not stained; paraphyses coherent, strict, the tips of some clavate and yellowish; hypothecium yellowish brown; asci inflated-clavate; spores 8, oblong, ellipsoid, 19 to 28  $\mu$  long, 8 to 12  $\mu$



thick, bilocular, brown, the lighter grayish colored spots round, some with indication of an isthmus.

On oaks in the San Gabriel Range at and above 800 meters elevation.

This has been sent by A. S. Foster from Westport, Washington, with a marked dull black hypothalline border and a somewhat darker thallus than the southern California lichen, growing on *Alnus*; also from the Santa Cruz Peninsula by A. C. Herre, the latter conforming in thallus and hypothallus to the southern lichen.

### 12. *Rinodina roboris* (Dufour) T. Fries.

Crust subdeterminate, whitish ash color, granular and chinky, KHO+ yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia generally numerous, sessile, 0.25 to 1 mm. wide; disk soon convex, brown black, the proper margin lighter in color and the thalline margin at last disappearing; hypothallus indistinct; spores the full size of those of *Rinodina sophodes*.

On various barks, dead wood, and fences. Frequent in the lowlands and ascending the mountains.

## PHYSICIACEAE.

Thallus foliaceous, appressed, passing to the fruticulose state and then ascending, mostly attached by means of rhizinae, corticate and in general outline orbicular, the gonidia *Pleurococcus*; apothecia sessile, lecideine or lecanorine; paraphyses simple; asci with 8 spores, these brown, bilocular, rarely in exotic forms 4-locular to submuriform; sterigma jointed; spermatia straight, short.

### KEY TO GENERA.

Cortex of upper surface evolved from upright hyphae.

Apothecia lecideine; disk with KHO+purple..... *PYXINE* (p. 127).

Apothecia lecanorine; disk with KHO—..... *PHYSICIA* (p. 128).

Cortex of upper surface formed of longitudinal hyphae; apo-

thecia lecanorine..... *ANAPTYCHIA* (p. 131).

### *PYXINE* Fries.

Apothecium becoming lecideine; thallus similar to that of *Physcia*, appressed, both the dorsal and ventral surfaces corticular, the hyphae of the former vertical to the thalline surface, the lower cortex less developed and having longitudinal hyphae; epithecium staining violet with KHO; spores as in *Physcia*.

#### 1. *Pyxine sorediata* (Ach.) Fries.

Thallus appressed, orbicular, creamy white, radiately rugulose toward the circumference, deeply lobed, the lobes contiguous, flattening, the border coarsely crenate, the lobes beset, particularly at the center, with soredia, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —, beneath white with grayish rhizinae; apothecia few and rarely present, adnate-sessile, lecideine, not over 0.5 mm. wide; disk flat, brown black; proper margin concolorous, persistent, entire; epithecium subgranulose, gray; thecium colorless, 72 to 76  $\mu$  high, with iodine blue (epithecium and hypothecium not stained); paraphyses free, with globular blackish heads, now and then forked above, the septation indistinct; hypothecium brown; asci clavate; spores 8, narrowly ellipsoid, pale brown to reddish brown, bilocular, 12 to 20  $\mu$  long, 4 to 7  $\mu$  thick, constricted, the epispore thin, the loculi often unsymmetrical in size, one being larger than its mate.

On dead and living *Sambucus glauca*, also on *Juglans californica*; rarely on rocks. Not uncommon in valleys and foothills, but very seldom with apothecia. Recorded as found throughout the United States east of the Rocky Mountains; also from Europe, southern and oriental Asia (Japan), Africa, and Oceania; southern Mexico, *Orcutt*.



**PHYSCIA** (Schreb.) Ach.

Thallus foliaceous, repeatedly lobed, lobes mostly narrow; apothecia circular, sessile, at times slightly elevated or subpedicellate, lecanorine; spores 8, brown, oblong to ellipsoid, bilocular (with us), the epispore thickened; sterigma multiarticular; spermatia short, straight, seldom acicular and bowed.

## KEY TO SPECIES.

Thallus appressed.

Thallus white to light gray.

Sorediate at center..... 3. *P. astroidea*.

Not sorediate.

White beneath.

Thallus orbicular, laciniate-radiate..... 4. *P. crispa*.

Thallus orbicular-stellate..... 1. *P. stellaris*.

Dark beneath..... 2. *P. aipolia*.

Thallus green gray..... 5. *P. adglutinata*.

Thallus not appressed, ascending more or less.

Some shade of gray.

Broadening at periphery..... 8. *P. tribacia*.

Not broadening at periphery.

Hooded at the extremities..... 6. *P. hispida*.

Not hooded..... 7. *P. setosa*.

From gray becoming reddish and brown.

Not pruinose, in color brown..... 10. *P. obscura*.

Pruinose throughout.

Thallus sorediate.

Densely coralloid-sorediate..... 9d. *P. pulverulenta*  
*isidiigera*.

Sorediate only on the margin of the laciniae..... 9c. *P. pulverulenta*  
*pityrea*.

Thallus not sorediate.

Thalline margin(exciple)crowned with lobules. 9b. *P. pulverulenta*  
*subvenusta*.

Thalline margin not lobulate.

Laciniae of thallus relatively broad..... 9. *P. pulverulenta*.

Laciniae of thallus narrowly linear..... 9a. *P. pulverulenta*  
*angustata*.

**1. Physcia stellaris** (L.) Nyl.

Thallus orbiculate-stellate, appressed, whitish to silver gray, glaucescent, beneath pale with pale rhizinae, KHO+yellow; apothecia sessile and subsessile, numerous; disk commonly plane, black or pruinose; thalline margin persistent, generally entire (or crenate); epithecium subcontinuous, yellowish gray; thecium colorless, 116 to 120  $\mu$  high; paraphyses rather loosely coherent, the colored tips clavate, not jointed; hypothecium colorless, milky; asci inflated-clavate, the thickened part reaching the epithecium; spores ovoid-ellipsoid, steel gray to brown, bilocular, 16 to 25  $\mu$  long, 10 to 12  $\mu$  thick, the lumina round or flat-obcordate; epithecium and thecium blue with iodine, KHO—.

Frequent throughout, on stones, bark, and dead wood, from the plains ascending the mountains to an elevation of 2,000 meters. Cosmopolitan.

**2. Physcia aipolia** (Ach.) Nyl.

Thallus stellate, loosely appressed, whitish to gray, glaucescent, epruinose, laciniate, the laciniae many-cleft, contiguous and imbricate, narrow, spreading toward the periphery and there also dilated, beneath brownish gray and darkening with gray or dark rhizinae, the surface and medulla yellow with KHO, Ca(ClO)<sub>2</sub>—; apothecia



rare with us, small, sessile; disk planoconvex, black, naked, the thalline margin entire, persistent; epithecium subcontinuous, yellowish gray; thecium 60 to 84  $\mu$  high, colorless, iodine staining it blue, as also, but not so readily, the epithecium and hypothecium; paraphyses loosely coherent, the septation not distinct; hypothecium colorless; asci inflated-clavate; spores 8, ellipsoid, brown, bilocular, 17 to 22  $\mu$  long, 8 to 11  $\mu$  thick, the lumina flat-obcordate with an isthmus.

On rocks and bark, through North and South America and Europe.

This and *Physcia stellaris* vary in width and division of laciniae and are similar plants, but distinguishable by the different chemical reaction. The thalline margin is well supplied with gonidia that also continue under the hypothecium.

### 3. *Physcia astroidea* (Fries) Nyl.

Thallus stellate-orbicular, appressed, microphylline at the periphery, the central part merged into a continuous mass of soredia; thalline medulla yellow with KHO, the yellow reaction with calcium chloride (Crombie) failing with us, dark beneath, rhizinae few and short; apothecia rather few, often absent; disk concave, black, pruinose; thalline margin erect, persistent, entire or lightly crenulate; epithecium subcontinuous, pale yellowish gray; thecium colorless, 84 to 96  $\mu$  high; paraphyses loosely coherent, the tips thickened and colored; hypothecium about the color of the epithecium, but slightly paler; asci clavate; spores 8, oblong-ellipsoid, 12 to 21  $\mu$  long, 7 to 10  $\mu$  thick, brown, bilocular, the epispore thin, the lumina round.

On bark, preferably that of *Juglans californica*, in the Santa Monica Range and at Highland Park near South Pasadena. It is reported throughout the United States and from southern Europe into Africa.

### 4. *Physcia crispa* (Pers.) Nyl.

Thallus orbicular, appressed, whitish, laciniolate-radiate, the laciniae broadly linear, convex, toward the periphery palmately cleft, spreading and dilating, the final divisions flattened and imbricate, beneath pale with few, short, white rhizinae, KHO staining the surface yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, from 0.25 to 1 mm. wide; disk flat, black, the thalline margin persistent, entire or finely crenulate; epithecium subgranulose, brown; thecium colorless, 40  $\mu$  high, blue with iodine including the epithecium and hypothecium; paraphyses coherent, with globular brown heads, furcation or septation not seen; hypothecium almost colorless (a faint yellow tinge); asci inflated-clavate; spores 8, ellipsoid, brown, bilocular, 13 to 24  $\mu$  long, 6 to 10  $\mu$  thick, generally not constricted; sterigma articulate, constricted; spermatia 4 to 6  $\mu$  long, a little over 1  $\mu$  thick, straight.

On bark of *Juniperus*, on the desert slope of the San Bernardino Range. Occurs in eastern United States; recorded from Polynesia.

### 5. *Physcia adglutinata* (Floerke) Nyl.

Thallus orbicular, small, sordid greenish gray or pale olive green, closely appressed, the laciniae discrete or contiguous, sparingly divided, mostly merging into a sorediate state; very rare in fruit with us, the spores 14 to 22  $\mu$  long, 8 to 11  $\mu$  thick.

On various barks; frequent on *Juglans californica* in the Santa Monica Range. Becoming conspicuously fresh green after rains. Throughout the United States; also in Europe.

### 6. *Physcia hispida* (Schreb.) Tuck.

Thallus small, white to silvery gray, the narrow, stellately arranged laciniae separate, loosely adherent to suberect, the ends of the more or less palmately cleft laciniae "vaulted and inflated," particularly the central ones, the peripheral inclining more to a spatulate, crenulate termination, the border of the laciniae loosely beset with spreading dark fibrils, beneath pure white, mealy; apothecia sessile, small, not exceeding 1.25 mm. in width; disk flat, black, naked or densely pruinose; thalline margin entire, erect; epithecium subcontinuous, brown; thecium colorless; para-



physes coherent, their tips clavate and colored, septate, a few furcate below the heads; hypothecium colorless; asci inflated-clavate; spores 8, bluntly ovoid-ellipsoid, 16 to 22  $\mu$  long, 7.5 to 9  $\mu$  thick, brown, bilocular, toward maturity slightly constricted; hymenial gelatine with iodine blue.

On barks chiefly, but also on rocks; rarely found in fruit. Throughout the United States; also in Europe and in Algeria.

**7. *Physcia setosa* (Ach.) Nyl.**

Thallus loosely appressed, gray and grayish brown, laciniate, the laciniae sinuate and lobed and cushioned upon a bed of short black fibrils, no reaction with potassium hydrate or calcium chloride; apothecia few, sessile, small, not over 1.25 mm. wide; disk concave, brown black; thalline margin incurved, turgid, entire, the amphithecium also with the characteristic fibrils; "spores 20 to 25  $\mu$  long, 10 to 14  $\mu$  thick." (Tuckerman.)

On earth (apparently); collected by T. S. Brandege in Lower California.

**8. *Physcia tribacia* (Ach.) Nyl.**

Lobes short, dilated, imbricate, suberect, lacerate-crenate and leprose-sorediate at the border, KHO+yellow, Ca(ClO)<sub>2</sub>—, beneath white with fine fibrillae; only sterile plants found.

Upon earth and rocks in the Santa Monica and San Gabriel Ranges.

**9. *Physcia pulverulenta* (Schreb.) Nyl.**

Thallus orbicular, loosely appressed, pale greenish to reddish brown, manifold-laciniate, the laciniae separate from the center, much cleft and spreading toward the periphery, hence contiguous and imbricate, the termination lobulate-crenate, pruinose especially toward the paling extremities of the laciniae, KHO—, beneath dark, paling outward, dark-fibrillose; apothecia sessile and subpedicellate, often crowded centrally, 0.5 to 2.5 mm. wide; disk concave to flat, densely pruinose; thalline margin persistent, erect (containing but few gonidia, none beneath the hypothecium), at times with several ray-like lobules; epithecium dark reddish brown, gradually fading downward, imposed upon it a thin hyaline layer (pruina?); thecium 140 to 144  $\mu$  high, faintly brownish, the lower part nearly colorless; paraphyses coherent, indistinctly septate, slightly clavate above, some furcate below the tips; hypothecium faint brown; asci clavate, reaching the lower border of the colored epithecium, the membrane thickened above; spores 8, ovoid, broadly ellipsoid, 24 to 32  $\mu$  long, 12 to 16  $\mu$  thick, bilocular, dark brown, constricted, the lumina large, round; all the hymenial structures stained blue with iodine, except the hyaline layer above the epithecium.

On barks and rock, throughout from the foothills and extending to higher elevations, where (above 1,000 meters) it attains its best development. Of its varying forms the following are found in our territory: Forma *leucoleiptes* Tuck., white with the "lobes flat, interruptedly elevated and powdery at the margins, beneath black"—on *Sambucus glauca* in the Santa Monica Range; forma *muscigena* (Ach.) Nyl., having the laciniae short and broad, imbricate, gray to mostly chestnut brown, very seldom found in fruit—on earth and rocks; and forma *argyphaea* Nyl., with the laciniae broader and shorter than in the species of the other forms, the distinguishing character, however, being the dense, white pruina covering disk and thallus—more common than the preceding forms but often sterile; on the ground and on rocks in the San Gabriel Range; on bark of *Fraxinus dipetala*, Topanga Canyon, Santa Monica Range.

**9a. *Physcia pulverulenta angustata* Nyl.**

Thallus in color like the species, but somewhat paler, the laciniae narrow, resting on dense cushions of dark fibrils.

On smooth oak bark along the "New Trail" to Wilson's Peak on the western slope of the San Gabriel Range at about 800 meters.



**9b. *Physcia pulverulenta subvenusta* Nyl.**

Thalline margin crowned with lobules, this about the only difference from the species. On bark, occasionally with the species.

Along the "Mormon Trail" below Skyland, San Bernardino Mountains, *Reed*; near "Lone Pine Mine" in the Tehachapi Mountains.

**9c. *Physcia pulverulenta pityrea* (Ach.) Nyl.**

Thallus smaller than the species, grayish to subcervine, the border of the laciniae sorediate-lined; sterile with us.

On wood and mossy rocks in the Santa Monica and San Gabriel ranges.

**9d. *Physcia pulverulenta isidiigera* Zahlbr.; Herre, Proc. Washington Acad. Sci. 7: 362. 1906.**

Thallus orbicular, thickened, appressed, of a somber brownish color, pruinose, the extremities of the laciniae visible, the body disguised by a dense growth of coralloid isidia; apothecia closely sessile; disk black, papillate, mostly epruinose; thalline margin thickened with the dense isidia; spores ovoid-ellipsoid, 26 to 36  $\mu$  long, 10 to 14  $\mu$  thick.

The type was collected by A. C. Herre at Mayfield. On moss-covered, shaded rocks in the north fork of Matilija Canyon, Ventura County; San Jacinto Mountains at 1,500 meters altitude, on bark of dead oak; Santa Ynez Canyon, Santa Monica Range.

**10. *Physcia obscura* (Ehrh.) Nyl.**

Thallus orbicular, dark gray to dark brown, the laciniae narrow, convex, palmately divided outward, appressed, beneath black and thickly black-fibrillose; apothecia (rare with us) from 0.5 to 2 mm. wide, adnate-sessile; disk flat, black, epruinose; thalline margin entire, persistent; epithecium dark brown, granulose; thecium colorless, 124  $\mu$  high, blue with iodine, then sordid greenish blue; paraphyses capitate and lightly colored above, septate; hypothecium faint brownish; asci elongated-clavate; spores 8, dark brown, oblong-ellipsoid, 16 to 30  $\mu$  long, 9 to 16  $\mu$  thick, bilocular, the lumina top-shaped, attenuate toward the septum.

On bark and mossy rocks; on bark in the Santa Monica Mountains; on decaying moss on rocks in Yosemite Valley. Throughout the United States, extending to the Arctic region; in Europe, northern Africa, and New Zealand.

**ANAPTYCHIA Koerb.**

Thallus from foliaceous to subfruticulose, repeatedly laciniate, diffusely prostrate or ascending, the laciniae generally narrow, flat or subcanaliculate, the upper cortex tough, resistant; apothecia round; disk dark, naked or pruinose; spores brown, bilocular.

**KEY TO SPECIES.**

With KHO the cortex yellow, the medulla unchanged..... 1. *A. erinacea*.

With KHO both cortex and medulla yellow..... 2. *A. leucomela*.

**1. *Anaptychia erinacea* (Ach.) Herre, Proc. Washington Acad. Sci. 12: 261. 1910.  
*Borrera erinacea* Ach. Lich. Univ. 499. 1810.**

Thallus erect and suberect, loosely branching, gray above, whitish beneath, the laciniae narrow below, dilating upward and becoming lobate, the border white, pulverulent and ecorticate, KHO+yellow, the medulla not staining, no reaction with calcium chloride; cortex arising from lengthwise running hyphæ; medulla thin, of narrow, wavy hyphæ, the gonidial layer on the whole nearer the lower surface, but changeable to middle or upper part; apothecia subpedicellate; disk black to pruinose, soon convex, the thin, entire margin then excluded; epithecium continuous, light reddish brown gradually paling downward; thecium 100 to 104  $\mu$  high, pale reddish brown above, almost colorless below; paraphyses coherent, with clavate, colored tips;



hypothecium about the color of the upper thecium, a thin gonidial layer underlying the hypothecium; asci clavate; all hymenial structures stained blue with iodine, no change with KHO; spores 8, oblong-ellipsoid, brown, 16 to 32  $\mu$  long, 7.5 to 15  $\mu$  thick; spermatia staff-shaped, 6 to 8  $\mu$  long.

On shrubs along the California coast and on the adjacent islands.

2. *Anaptychia leucomela* (L.) Herre, Proc. Washington Acad. Sci. 12: 261. 1910.

*Lichen leucomelos* L. Sp. Pl. ed. 2. 1613. 1763.

Loosely suberect, pale greenish ash color, glaucescent above, beneath white, channeled, the laciniae linear, sparingly divided, latterly furcate at the extremities, the border with strong, blackening, forked fibrils, with KHO the cortex and medulla yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia pedicellate; disk dark, pruinose, the thalline margin lobulate; epithecium continuous, dark greenish brown; thecium colorless, 92 to 96  $\mu$  high; paraphyses coherent, the tips thickened and colored, some furcate above; hypothecium pale straw color; asci inflated-clavate, all hymenial structures staining blue with iodine; spores 8, oblong-ellipsoid, 22 to 24  $\mu$  long, 10 to 13  $\mu$  thick, bilocular, brown, the lumina rounded, becoming flat, with an isthmus; a thin gonidial layer underlying the hypothecium.

The fruiting specimen from which the description is taken was collected near Cape San Quentin, Lower California, by Dr. E. L. Greene. Specimens from Santa Catalina and Santa Rosa islands, *Trask*, are sterile.



# STUDIES OF TROPICAL AMERICAN FERNS—NO. 4.

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BY WILLIAM R. MAXON.

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## INTRODUCTION.

The present paper, like the preceding ones of this series,<sup>1</sup> includes brief discussions of several genera or smaller groups of species which have been the subject of great confusion, but which it is now possible to treat with some degree of assurance. Similar conditions prevailing in very many, if not in most, genera of tropical American ferns lead to the conclusion that effort in this field should at present be directed more to the systematizing of work already done than to the description of new forms. The preservation of most of the older type specimens in European herbaria affords to European students a distinct advantage which is, perhaps, not fully realized. At any rate very little monographic or even synoptical work upon the part of European fern students has recently found its way into print, a noteworthy exception being the conscientious and elaborate work of Christensen in the difficult genus *Dryopteris*.

Indeed, the method of treatment adopted by Christensen, involving a critical review of actual type specimens, supplemented by a study of the vast aggregate of additional material which it is now possible to bring together from the larger herbaria, may well serve as a model. Studies like this are urgently required in *Adiantum*, *Pteris*, *Blechnum*, certain groups of *Asplenium* and *Athyrium*, *Hypolepis*, *Dennstedtia*, *Lindsaya*, and *Polystichum*—to mention a few of the more conspicuous examples. Many of the species of these genera are without doubt correctly understood by fern students generally; but it is equally true that a large proportion of the less well known species have been repeatedly published as new, partly from ignorance or disregard of results obtained by others, and partly from failure to interpret successfully the faulty diagnoses of others, especially the early writers. The necessity of studying and restudying the constantly increasing number of scattered descriptions imposes a heavy burden

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<sup>1</sup> Contr. U. S. Nat. Herb. 10: 473-508. pls. 55, 56. March 30, 1908. Ibid. 13: 1-43. pls. 1-9. June 30, 1909. Ibid. 16: 25-62. pls. 18-34. June 19, 1912.



upon the student who is desirous of avoiding the publication of "new" species which will ultimately be relegated to synonymy. Relief will be found only in the manner mentioned—by the publication of synopses of the genera, with full synonymy.

The much larger task of preparing an authoritative treatment of the Pteridophyta as a whole would at the present time be beset with difficulties of many sorts; in part those inherent in any full treatment of so large and difficult a group, in part others of the kind encountered in many groups of lower cryptogams especially, in which there has been not only a lack of stability in the generic concept, but also no general agreement upon a method of selecting the generic type. Many of the genera present other and grave difficulties which need not here be enumerated. In the endeavor to order the species by genera according to their affinities it will often be necessary to disregard differences of venation and the presence, absence, or modification of special structures like the indusia, which, though formerly regarded as all-important, are now frequently found to be characteristic of species only or of minor groups of species, and on the other hand to lay greater stress upon habital characters, these, though less tangible, serving to indicate far more accurately the probable lines of descent. The recognition of genera upon this basis will necessitate a wide comparison of specimens from regions now isolated, and will, unfortunately, afford fewer absolute superficial criteria to the maker of the generic keys. But this inconvenience carries small weight against the more natural arrangement which will certainly result, involving also a possible reduction in the number of genera.

Inability or lack of opportunity to deal with the subject in a large way should not, in any case, serve to delay critical studies of the smaller groups, whose limits and principal characters can be clearly indicated. Studies of the latter sort may often be carried to completion merely as phases of the larger work and will prove useful not only in themselves but also in their bearing upon the study of related groups of Pteridophyta. Considering the great amount of exploration carried on in the past it is only natural that so much attention should have been given purely to the description of new species; but this pioneer work having in great measure been accomplished, it may reasonably be expected that, with the benefit of modern systematic methods now generally employed, a more serious attempt will be made in the immediate future to definitely systematize the knowledge which we now have.

#### **ASPLENIUM TRICHOMANES AND ITS AMERICAN ALLIES.**

The writer's especial interest in the group of *Asplenium trichomanes* dates from 1900, when he described *Asplenium vespertinum* from specimens collected in San Diego County, California. This well-



marked species had been strangely confused with a nearly or quite sterile, incised, leafy form of true *A. trichomanes* which occurs in Europe and has been found once or twice in the eastern United States. *Asplenium vespertinum* is, however, but one of a group of rather closely related species, well represented in the American tropics and mostly marked by excellent characters, whose relationship and limitations are not well understood. In view of this fact it has seemed desirable to bring together the following notes, and to publish a key by means of which the several species may be identified. To this end the writer has examined critically the specimens in most of the larger American herbaria and has had also the benefit of specimens and data obtained in field work over a large part of the area covered. As must often be the case, the number of species to be recognized has decreased materially as specimens and data have accumulated.

*Asplenium heterochroum* and *A. castaneum* will serve as excellent examples. The former species is known chiefly from Bermuda and Florida specimens which latterly have been called *A. muticum*; and only upon the very recent collection of adequate Cuban material has it been found that Kunze's *A. heterochroum*, described from imperfect Cuban specimens and nearly lost sight of since its publication in 1834, really represents the same species in slightly different form, the name *heterochroum* therefore applying to the whole. In the case of *A. castaneum* there has been not only a recent redescription under the name *A. rubinum*, but also a very general failure to note the unusually wide extremes of leaf form within the species, the difference amounting almost to the development of two types of fertile fronds, as explained later.

Considering the proneness of ferns to extreme variation, it must be apparent that, in the case of many old as well as new or little known species, the advantage to be gained from studying a large series of specimens is very great, since only in this way will it be possible to determine the extent not only of unusual variation, but even of the normal fluctuation which is inherent in nearly every species. Besides variations of the latter type, relatively and actually very great in ferns, unusual attention must be given to transitional states which may commonly be correlated with geographical distribution. With large series at hand extreme variants are not so likely to be described as new species. For the sake of determining distribution and relationship, also, unusually extensive collecting is necessary in so variable a group. In no other way will it be possible to know tropical ferns so thoroughly as we know those of temperate regions, the latter from our constant observation of them in the field and herbarium being more or less familiar in all their phases. We often forget that tropical ferns offer a similar or even greater range of variation, and that the chance collecting of a few specimens



from scattering localities in all probability affords a wholly insufficient basis for determining the mean of the species. A suitable series of specimens has been available in the present study, and the number of species here recognized is probably not far from correct.

As delimited below, the group of *Asplenium trichomanes* is a natural and fairly compact one, though there are numerous species which connect it with several related groups of simply pinnate species. Among these may be mentioned that of *Asplenium viride*, including such small species as *A. fragile*, *A. quitense*, and *A. flabellifolium*, characterized by green or greenish stipes; that of *A. erectum*, with a multitude of species, mostly with larger fronds, the stipes dull brownish to greenish or grayish green; that of *A. normale*, containing species with polished dark brown or blackish stipes and differing from the *trichomanes* group by their larger and relatively broader fronds. These in turn pass into bipinnate and tripinnate forms so gradually and in such infinite variety that a natural arrangement of the species of the genus as a whole is exceedingly difficult. However, keeping in mind the principal characters of *A. trichomanes* as representative, little difficulty need be experienced in associating the various members of this group, which may be characterized briefly as follows:

#### ASPLENIUM TRICHOMANES GROUP.

Small ferns, mostly 10 to 30 cm. high, the once-pinnate fronds nearly linear, tufted upon an erect or ascending, usually short rhizome, the stipes and rachises firm, subterete to trigonous, bright brown or castaneous to black or purplish black, minutely to broadly alate, sometimes sparingly fibrillose-scaly; pinnæ mostly small, equilateral to strongly asymmetrical; venation pinnate to flabellate-dichotomous.

The American species may be separated by means of the following artificial key:

#### KEY TO THE SPECIES.

- Fronds mostly rooting at the tip of the flagelliform apex..... 10. *A. palmeri*.  
 Fronds not rooting at the apex, this not flagelliform.  
   Indusia conspicuously ciliate or laciniate.  
     Veins forked; indusia delicately ciliate; rachis scantily  
       pubescent..... 5. *A. blepharodes*.  
     Veins simple; indusia deeply laciniate; rachis distinctly  
       fibrillose..... 4. *A. fibrillosum*.  
   Indusia entire to crenulate or somewhat erose.  
     Fronds apparently pendent; pinnæ distant..... 11. *A. extensum*.  
     Fronds erect, ascending, or rotate; pinnæ closer.  
       Sterile and fertile fronds difform, the sterile ones prostrate or nearly so..... 15. *A. platyneuron*.  
       Sterile and fertile fronds similar, not arranged in two series.  
         Sori borne mostly upon the inferior (proximal) side of the pinnæ.  
           Pinnæ deeply cleft upon the upper margin; fronds very numerous, the stipes and rachises slender, blackish..... 13. *A. formosum*.



- Pinnæ denticulate to crenate-serrate upon the upper margin; fronds less numerous, the stipes usually stouter, castaneous.
- Scales of the rhizome brownish to blackish, often iridescent..... 17. *A. monanthes*.
- Scales of the rhizome light ferruginous ..... 16. *A. denudatum*.
- Sori borne mainly in pairs, i. e. those of the distal and proximal sides nearly equal in number.
- Fertile veins (some or all, exclusive of the basal ones) forked.
- Lamina 5 to 9 cm. broad; pinnæ relatively few.
- Pinnæ 10 to 20 pairs, all but the basal ones narrowly oblong from an acute or subrectangular inequilateral base, obtuse..... 18. *A. melanorachis*.
- Pinnæ 7 or 8 pairs, much larger, distant, strongly deltoid from a broadly cuneate inequilateral base, acute ..... 19. *A. kellermanii*.
- Lamina 1 to 3 (rarely 4) cm. broad; pinnæ numerous.
- Pinnæ deeply crenate-serrate or incised; rhizome scales yellowish brown, with a heavy dark median stripe..... 14. *A. carolinum*.
- Pinnæ subentire to crenate; rhizome scales dark brown or blackish.
- Sori short, borne near the margin; scales with long capillary apices..... 9. *A. resiliens*.
- Sori relatively longer, nearer the midvein than the margin; scales merely long-attenuate.
- Stipes and rachises conspicuously alate, more or less fibrillose; fronds few; pinnæ subrectangular-oblong; veins of the proximal side simple..... 8. *A. nesioticum*.
- Stipes and rachises faintly alate, not fibrillose; fronds very numerous; pinnæ oval to oval-oblong; veins of both sides usually forked..... 1. *A. trichomanes*.
- Fertile veins (the distal basal ones excepted) usually simple.
- Scales of the rhizome light ferruginous..... 16. *A. denudatum*.
- Scales of the rhizome brown to blackish.
- Sori confined to the lobes of the pinnæ..... 3. *A. pringlei*.
- Sori not borne upon the lobes.
- Stipes and rachises black or blackish.
- Pinnæ broadly crenate; stipes and rachises very slender, minutely alate..... 2. *A. underwoodii*.
- Pinnæ sharply crenate-dentate; stipes and rachises stouter, conspicuously alate.... 6. *A. heterochroum*.
- Stipes and rachises castaneous or distinctly brown.
- Rhizomes short; fronds closely fasciculate, ascending or rosulate, strongly arcuate..... 7. *A. vespertinum*.



Rhizomes large, woody, elongate (2 to 10 cm. long); fronds densely imbricate, erect.

Indusia entire, usually narrow and elongate..... 17. *A. monanthes*.

Indusia noticeably erose, more ample, short and relatively very broad..... 12. *A. castaneum*.

**1. *Asplenium trichomanes* L. Sp. Pl. 1080. 1753.**

*Phyllitis rotundifolia* Moench, Meth. Pl. 724. 1794.

*Asplenium saxatile* Salisb. Prodr. Stirp. 403. 1796.

*Asplenium melanocaulon* Willd. Enum. Pl. 1072. 1809.

*Asplenium microphyllum* Tineo in Gussone, Fl. Sic. Syn. 2<sup>1</sup>: 884. 1844.

TYPE LOCALITY: Europe.

DISTRIBUTION: Generally distributed in Europe, and in North America from Alaska and the region of Hudson's Bay southward to Alabama, Texas, and Arizona.

ILLUSTRATIONS: Schkuhr, Krypt. Gewächs. 1: pl. 74; D. C. Eaton, Ferns N. Amer. 1: pl. 36. f. 1-3; Moore, Brit. Ferns Nat. Pr. 2: pl. 75; Williamson, Ferns Kentucky pl. 16; Bolton, Fil. Brit. pl. 13; Hook. Fl. Lond. pl. 156; Sowerby, Ferns Great Brit. pl. 30.

*Asplenium trichomanes*, as represented by the common plant of Europe and North America, is too well known to require redescription or full citation of its very numerous illustrations, and it is doubtful whether in its typical form it occupies a much wider area. Certainly the writer has seen no material from other regions which is unmistakably the same. Thus, *Asplenium anceps* von Buch,<sup>1</sup> illustrated by Hooker and Greville,<sup>2</sup> appears to be a distinct species, though not so regarded by Milde.<sup>3</sup> Although it has been attributed to Great Britain it is apparently confined to the Azores and Canary Islands. *Asplenium newmani* Bolle,<sup>4</sup> founded upon specimens from Palma, of the Canaries, is a related species recognized by both Milde and Christensen.

Of the Asiatic specimens of this alliance there are more distinct specific forms than have as yet been recognized. That which approaches North American specimens most closely is found in Japan, but it differs materially in several important particulars and probably represents a valid species about equally related to *Asplenium trichomanes* and *A. anceps*. Out of the Chinese material the writer has segregated *A. microtum*,<sup>5</sup> and Copeland has published also *A. stantoni*,<sup>6</sup> from Luzon, both of which, as well as *A. densum* Brack.,<sup>7</sup> a native of the Hawaiian Islands, seem to be well founded. These, together with additional material from Central China, South Africa, and New Zealand, will be considered separately at a later time, since their status does not affect materially that of the species here discussed.

**2. *Asplenium underwoodii* Maxon, sp. nov.**

FIGURE 1.

Rhizome ascending, slender, 4 to 5 mm. in diameter, at the summit densely paleaceous, the scales rigid, linear-lanceolate, attenuate, opaque, dark brown, about 3 mm. long; fronds few (4 to 10), radiating, somewhat arcuate toward the base, 12 to 21 cm. long (averaging about 16 cm.); stipe 2.5 to 6.5 cm. long (averaging about 3.5 cm.), very slender and fragile, deep purplish black, somewhat lustrous, both stipe and rachis very narrowly alate, the wings subentire; lamina linear, 9 to 14.5 cm. long,

<sup>1</sup> Beschr. Canar. Ins. 189. 1825.

<sup>2</sup> Icon. Fil. 2: pl. 195. 1830.

<sup>3</sup> Fil. Eur. Atlant. 62. 1867.

<sup>4</sup> Bonplandia 7: 106. 1859.

<sup>5</sup> Contr. U. S. Nat. Herb. 12: 411. pl. 60. 1909.

<sup>6</sup> Philippine Journ. Sci. Suppl. 1: 151. 1906.

<sup>7</sup> In Wilkes, U. S. Expl. Exped. 16: 151. pl. 20. f. 3. 1854.



10 to 14 mm. broad; pinnae 20 to 25 pairs, sessile, approximate or sometimes nearly their width apart, opposite or subopposite, characteristic middle ones oblong, 5 to 6.5 mm. long, 3.5 to 4 mm. broad, at the base broadly cuneate, the margins elsewhere regularly and broadly crenate, the apex obtusely rounded; lower pinnae shorter, 2.5 to 3.5 mm. long, 3.5 to 4 mm. broad, horizontal; sori oblong, averaging 3 pairs to each pinna, nearly medial upon the spreading simple veins; indusia membranous, whitish, glabrous, the margin somewhat sinuate or slightly erose; spores ovoid, more or less alate, densely muricate-cristate.

Type in the U. S. National Herbarium, no. 427538, collected from chinks of a cliff in humid forest on the upper slopes of John Crow Peak in the Blue Mountains of Jamaica, altitude between 1,650 and 1,800 meters, April 18, 1903, by William R. Maxon (no. 1319), in company with Prof. L. M. Underwood, whose specimens are in the Underwood Fern Herbarium of the New York Botanical Garden.

One of the rarest and most delicate of the Jamaican species, somewhat resembling *A. trichomanes*, with which it was confused by Jenman, but differing in several essential characters, notably in its few and exceedingly delicate fronds, in its very slender and dark-colored vascular parts, and in its fewer sori and simple veins. It has been collected at the type locality also by Harris, whose specimens (nos. 7338, 7902 in part) are in the Underwood Fern Herbarium, and by Hart.

3. *Asplenium pringlei* Davenp. Gard. & For. 4: 449. 1891.

TYPE LOCALITY: Wet cliffs near Guadalajara, State of Jalisco, Mexico, December 5, 1888 (*Pringle* 1837).

DISTRIBUTION: Known only from the States of Jalisco and Chihuahua, Mexico.

ILLUSTRATION: Loc. cit. 4: f. 71.

The present species, which seems to have been gathered only by Mr. Pringle, is by far the most strikingly peculiar one of the group. In describing it Mr. Davenport compared it with the "incised form of *Asplenium trichomanes*," meaning particularly no doubt the species since described as *A. vespertinum*. But it has no close relationship with that species, the deeply lobed pinnae and the unique submarginal position of the sori setting it apart from that as from all other members of the group. The lobes of the pinnae are rounded, yet appear more or less acute and distant in the dried specimen, owing to the usual inflection of the margins. The sori are short, tumid, and very conspicuous, being placed wholly within the deep lobes and near to the margin.

The following specimens have been examined: <sup>1</sup>

MEXICO: Wet cliffs and mossy ledges near Guadalajara, State of Jalisco, *Pringle*, 1837 (N, Y); *Pringle* 2769 (M, P); *Pringle* 4089 (herb. B. D. Gilbert). Sierra Madre, Chihuahua, October 21, 1887, *Pringle*, without number (P).

4. *Asplenium fibrillosum* Pringle & Davenp. Bot. Gaz. 21: 257. 1896.

TYPE LOCALITY: Mossy banks, canyons above Cuernavaca, State of Morelos, Mexico, altitude 1,650 meters, November 21, 1895 (*Pringle* 6191).

DISTRIBUTION: Known only from the States of Mexico and Morelos, Mexico.

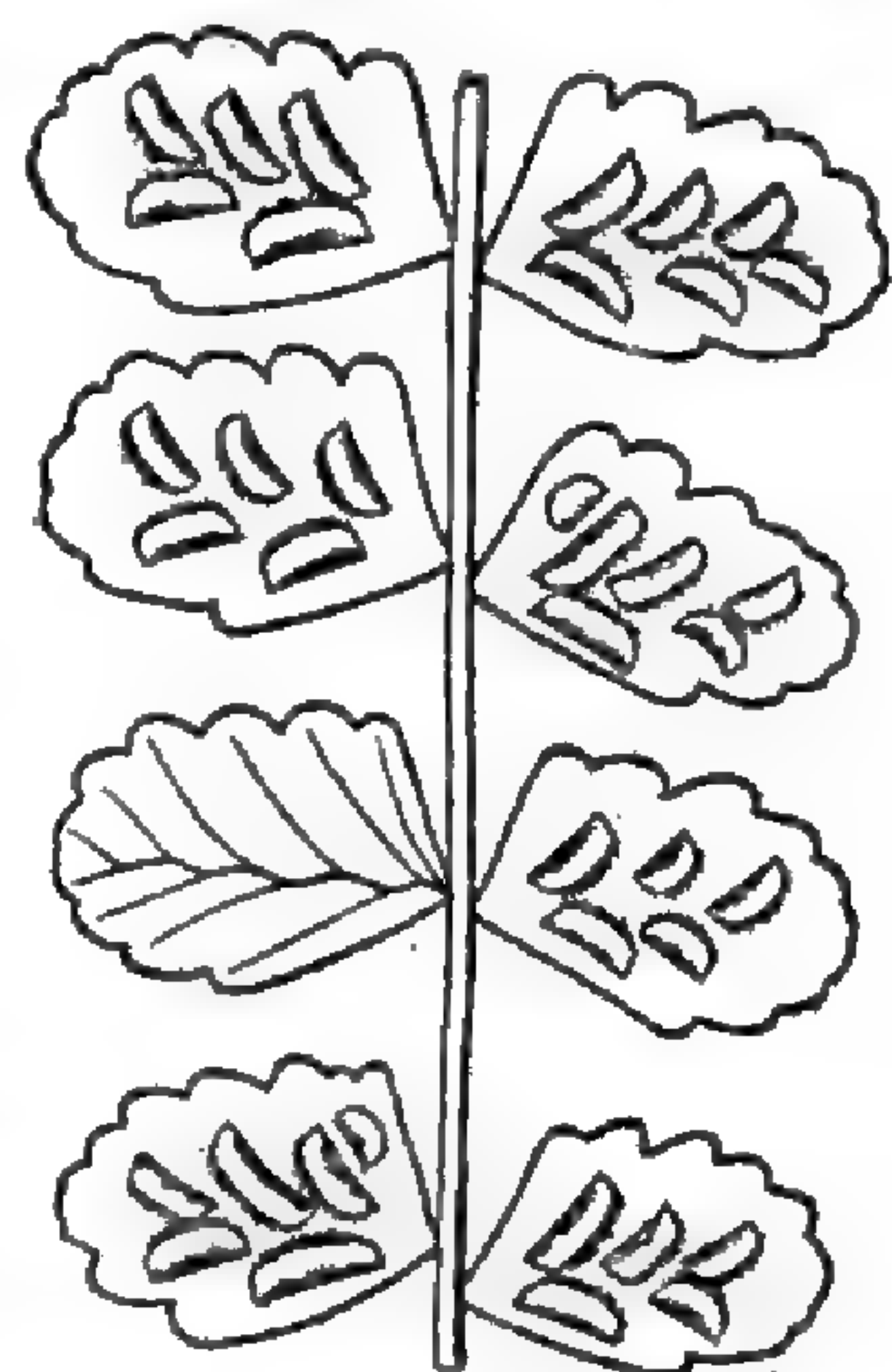


FIG. 1.—*Asplenium underwoodii*. Part of type specimen. Scale 2.

<sup>1</sup> The herbaria from which specimens are cited are indicated by the following letters: E, D. C. Eaton Herbarium, Yale University; G, Gray Herbarium; M, Herbarium of the Missouri Botanical Garden; N, Herbarium of the U. S. National Museum (U. S. National Herbarium); P, Pringle Herbarium, University of Vermont; Y, Underwood Fern Herbarium, New York Botanical Garden.



ILLUSTRATION: Op. cit. 21: pl. 18. f. 1-4.

There is little to be added to Mr. Davenport's careful diagnosis, except that some specimens (e. g., *Rose & Painter* 7857) attain a greater width (1.8 cm.), and that the texture may be called truly coriaceous. The veins though obscure are simple, as opposed to the once-forked veins of its nearest ally, *A. blepharodes*, a species which Mr. Davenport appears to have overlooked. The fibrillose character appears to be a constant one. The indusia are deeply laciniate, and the long, jointed, flaccid, white cilia sometimes attain a length greater than the width of the indusium proper. Large specimens have 4 or 5 pairs of sori to each pinna, with an occasional extra one upon the auricle.

The following specimens have been examined:

MEXICO: Mossy banks, canyons above Cuernavaca, State of Morelos, alt. 1,650 meters, November 21, 1895, *Pringle* 6191 (N, Y, M). Sheltered ledges and grottos in the lava fields near Eslaba, Federal District, September, 1903, *Pringle* 8791 (N, P). Mossy banks near Cuernavaca, State of Morelos, alt. 1,500 meters, November 13, 1902, *Pringle* 11257 (N). Near Tultenango, State of Mexico, October 13, 1903, *Rose & Painter* 7857 (N).

**5. *Asplenium blepharodes* D. C. Eaton, Zoe 1: 197. 1890.**

TYPE LOCALITY: Sierra de la Laguna, Lower California (*Brandeggee*).

DISTRIBUTION: Lower California.

ILLUSTRATION: Loc. cit. 1: pl. 7.

Confined apparently to Lower California, and collected there thus far only within a restricted region; to be compared only with *A. fibrillosum*. In the specimens studied the vascular parts are not fibrillose; the sori are longer and make a more acute angle with the midvein than in *A. fibrillosum*; and the indusia are more regularly and delicately ciliate, the cilia shorter. The most unmistakable point of difference lies in the forked veins, those of *A. fibrillosum*, as noted under that species, being simple. The fronds, moreover, are chartaceo-membranaceous (instead of coriaceous) and the margins are bicrenate-serrate.

The following specimens have been examined:

MEXICO: Sierra de la Laguna, Lower California, January 23, 1890, *Brandeggee* 660 (N); *Brandeggee*, without number, January 24, 1890 (N). Laguna, Lower California, *L. Belding* 17 (G).

**6. *Asplenium heterochroum* Kunze, Linnaea 9: 67. 1834.**

FIGURE 2.

*Asplenium muticum* Gilbert, Amer. Bot. 4: 86. 1903.

TYPE LOCALITY: Mossy shaded rocks, Embarcadero del Caminar, Cuba (*Poeppig*).

DISTRIBUTION: Mountains of eastern Cuba, ascending to 500 meters; also in peninsular Florida and Bermuda.

This species was described as new several years ago under the name *Asplenium muticum* by Gilbert, who studied only Bermuda and Florida material, his type specimen being from Bermuda. More recently Cuban specimens have been collected which clearly represent *Asplenium heterochroum* Kunze, and a comparison of these with the plants of Bermuda and Florida shows all to be of the same species, notwithstanding certain minor variation in size and form. The Bermuda specimens are the best developed of all, a few individuals attaining a height of nearly 50 cm. The plants from Florida and Cuba are rarely more than 20 cm. high. *Poeppig's* original specimens, as evidenced by a diminutive example in the herbarium of the Missouri Botanical Garden, were even smaller (less than 10 cm. high), but are otherwise like recent Cuban material.

*Asplenium heterochroum* is related to *A. nesioticum* of the Blue Mountains of Jamaica, from which it differs mainly in its sharply crenate-dentate margins and membranous texture, the veins usually being readily apparent by transmitted light. From *A. resiliens*, with which it was long confused in Florida, it differs conspicuously in its



chaff, which, though attenuate, is never hair-pointed, in the shape and position of its sori (these longer and much nearer the midvein), in its thin rather than decidedly coriaceous texture, and usually in the character of its margins. The reduced lower pinnæ also are broadly cuneate and more or less flabelliform, never auriculate-cordate as in *A. resiliens*.

The following specimens have been examined:

CUBA: Ad rupes umbrosas muscosas, ad Embarcadero del Caminar, *Poeppig* (M). Near Nouvelle Sophie, on vertical rocks and ledges, sides of the Farallones, October 8, 1859, *Wright* 1042 (E). Sierra Cubitas, Camaguey, east pass, at mouth of cave, *Shafer* 446 (N). "Posesion de Starck," southeast of Jaguey, Yateras, Oriente, alt. about 500 meters, in crevices of partially shaded precipice, *Maxon* 4433 (N). Finca Las Gracias, Yateras, Oriente, alt. 500 meters, in clefts of small rock ledges in forest, *Maxon* 4497 (N).

BERMUDA: Limestone sinks or shaded ledges, several localities, *Goode* (M, N); *Kemp* (Y); *Maxon* (G, M); *Farlow* (G); *Gilbert* (G, Y, N, Gilbert); *Howe* (Y); *Harshberger* (N); *S. Brown & Britton* 29 (N).

FLORIDA: Shaded rocks, Appalachicola River, near Aspalaga, *Curtis* 3720\* (Y, N, P, E, M)<sup>1</sup>. Rocky woods near Istachatta, *Curtiss* 5966 (Y, N, M, P). Limestone rocks around sink holes, Ocala, *Gilbert* (N); *Underwood* 132 (N). Columbia County, *Hitchcock* (M). Indian River, *Miss Reynolds* in 1878 (M). Sumter and Marion counties, in 1879, with *A. resiliens* intermixed, *J. D. Smith* (N).

7. *Asplenium vespertinum* Maxon, Bull. Torrey Club 27: 200. 1900. FIGURE 3.

TYPE LOCALITY: San Miguel Mountain, near National City, San Diego County, California (*Laura F. Kimball*).

DISTRIBUTION: Southern California and Lower California.

Except for the single locality in Lower California, *Asplenium vespertinum* is known only from the mountains of southern California. It has a certain relationship to *A. blepharodes*, but is easily distinguished by its differently shaped crenations, shorter and more numerous sori, and nonciliate indusia.

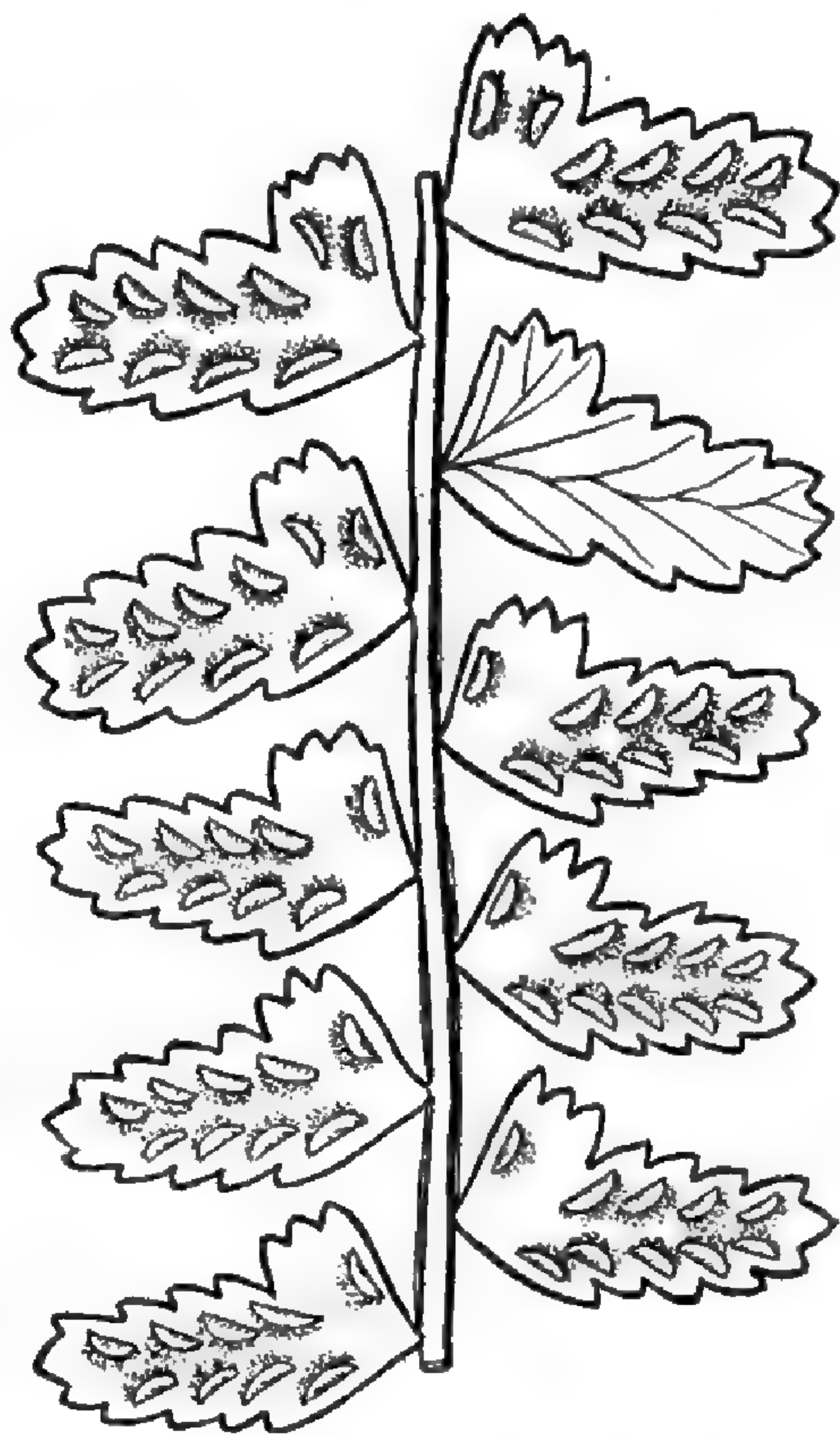


FIG. 2.—*Asplenium heterochroum*. Collected in Bermuda by Gilbert. Scale 2.

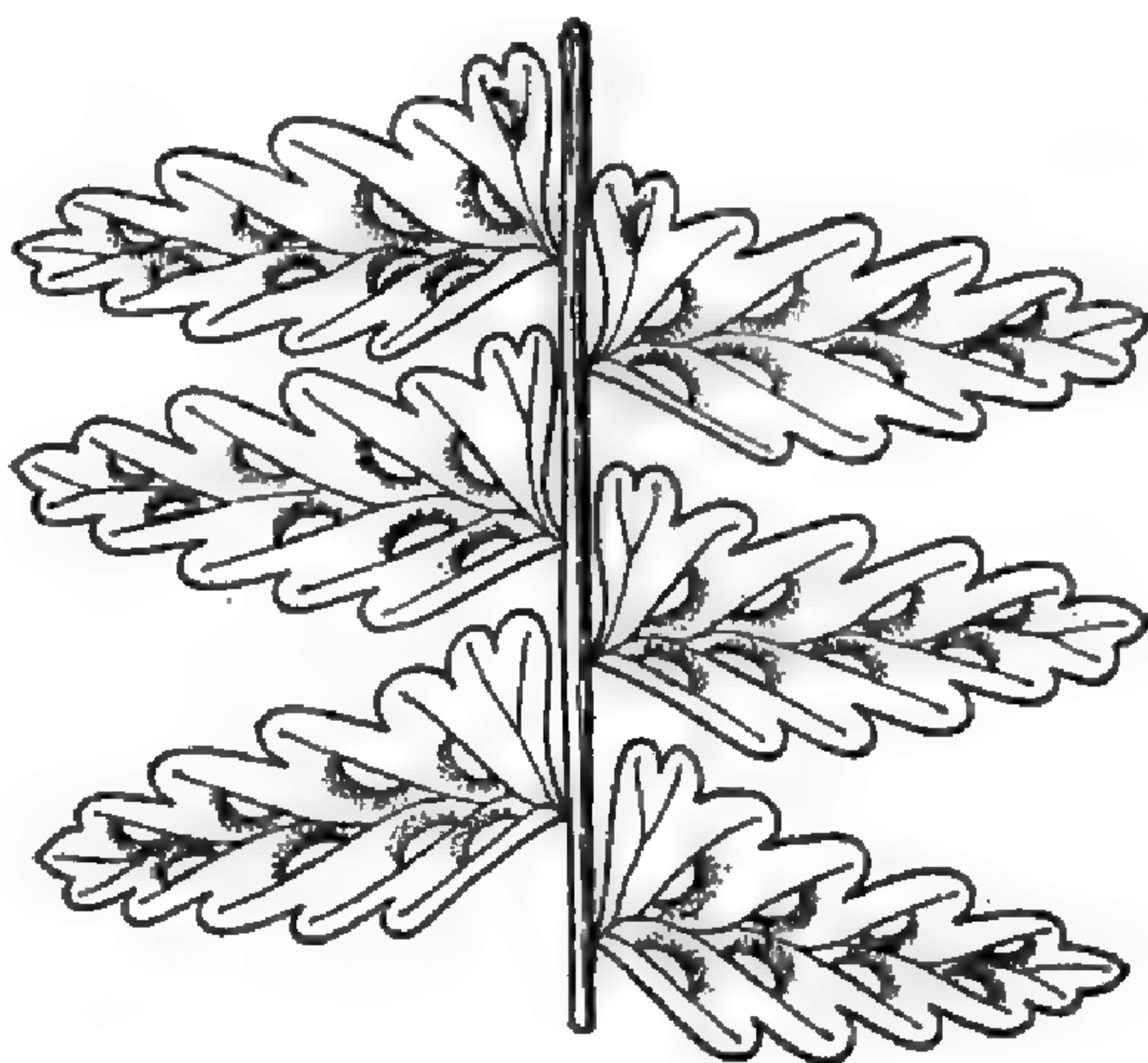


FIG. 3.—*Asplenium vespertinum*. Part of type collection. Scale 2.

<sup>1</sup> In several herbaria this number is partly *A. resiliens*.



The following specimens have been examined:

CALIFORNIA: San Diego, *Cleveland* (N); *Miss Barbeck* (E); *Lemmon* (M). San Diego County, *Stout* (Y). San Miguel Mountain, near National City, San Diego County, *Miss Kimball* (N). Moreno Canyon, San Diego County, *Stout* (Y). Near Poway, San Diego County, *Stout* (P, E). Vicinity of Santa Ysabel, *Henshaw* (N). Tufts under rocks, Cajon Valley, near San Diego, *Newberry* (E).<sup>1</sup> San Gabriel Mountains, near Pasadena, *McClatchie* (N). San Bernardino, *Spellman* (Y). Without locality, *Parry* (E). Witch Creek, San Diego County, *R. D. Alderson* (herb. A. A. Eaton).

MEXICO: Near San Rafael, Lower California, April 13, 1882, *M. E. Jones* 3749 (N).

[San Rafael?,] Lower California, April 13, 1882, *Pringle*, without number (P).

8. *Asplenium nesioticum* Maxon, sp. nov.

FIGURE 4.

An erect plant, with 6 to 9 linear rigid dark green fronds, 12 to 19 cm. long. Rhizome short, decumbent or erect, 6 to 8 mm. in diameter, the upper part clothed with numerous narrowly lanceolate attenuate dark brown scales 3 to 3.5 mm. long; stipe 2 to 4 cm. long, very dark purplish brown, subglucid, conspicuously alate (the wing

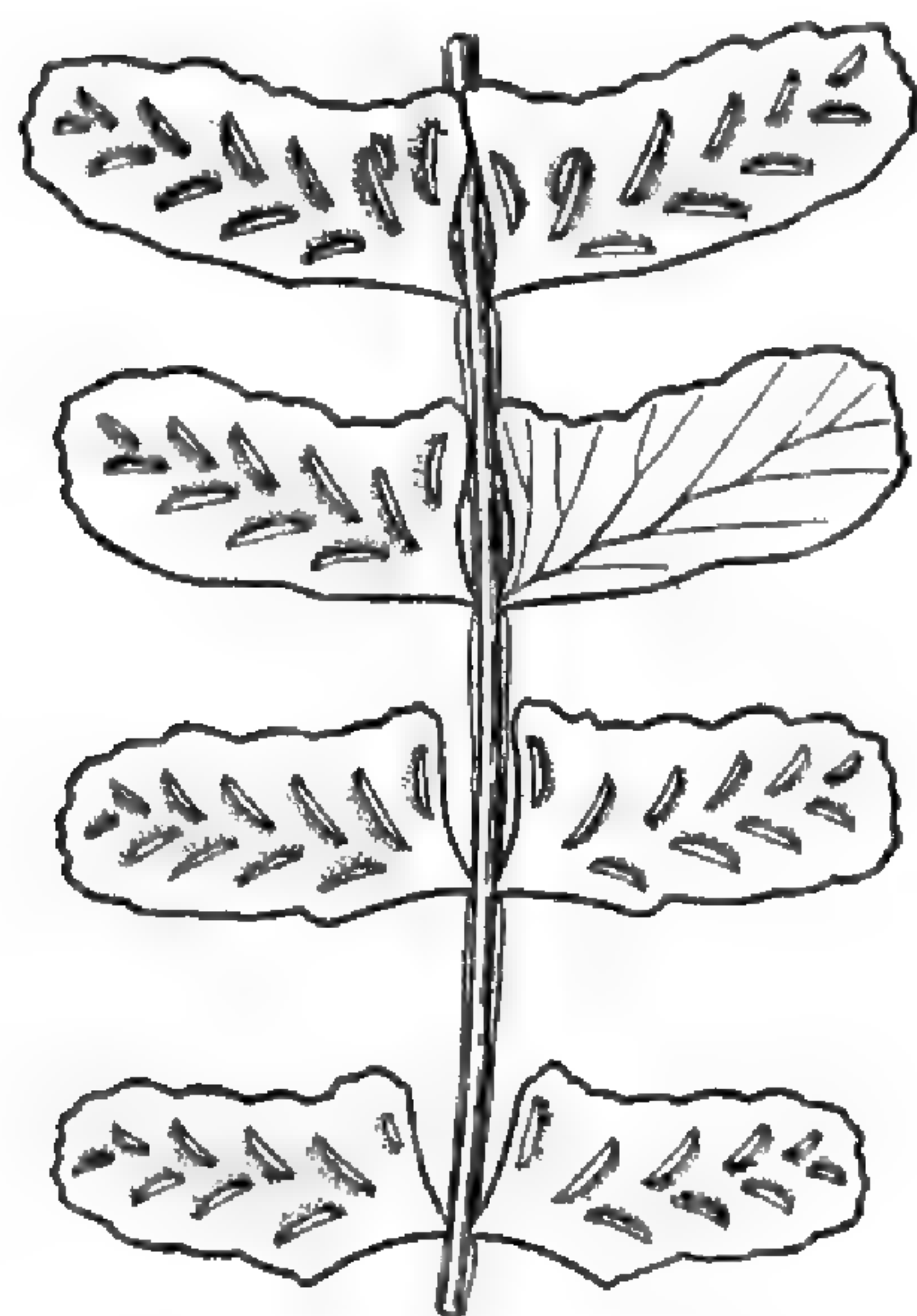


FIG. 4.—*Asplenium nesioticum*. Part of type specimen. Scale 2.

yellowish brown, entire) and sparingly fibrillose with dark deciduous scales similar to those of the rhizome but reduced and finally filiform; lamina 10 to 16 cm. long, 1.5 to 2 cm. broad, tapering in both directions (but more gradually below), the apex short-elongate, deeply crenate or lobate; pinnæ 18 to 25 pairs, sessile, coriaceous, opaque, nearly glabrous, with a few scattered whitish hairs below; characteristic middle pinnæ 8 to 12 mm. long, 3 to 5 mm. broad, horizontal, oblong, slightly curved, attached at the base of the inner margin, the base above subrectangular-auriculate, the margins elsewhere sinuate, obscurely or sometimes regularly crenate, the crenations most pronounced at the rounded apex, the lower margin usually sinuate only; lower pinnæ gradually much reduced, somewhat reflexed, distant, subtriangular or the lowermost suborbicular to flabelliform, their base broadly cuneate, medial in attachment; rachis similar to the stipe, more widely

alate, a few filiform scales borne at the base of the pinnæ; veins pinnate, the basal superior one 2 or 3-forked, the others simple or once-forked, the lower veins simple; sori elongate, linear, slightly curved, originating close to the midvein and always borne

<sup>1</sup> This locality was originally published by the writer as follows: "Tufts under rocks, Cajon Pass (San Bernardino County,) near San Diego Mission, Nov. 9, 1857, Dr. Newberry." The following note, received from Mr. S. B. Parish under date of August 17, 1901, not only calls attention to a probable error but also gives interesting data as to the distribution of the species:

"Permit me to call your attention to a confusion of localities in a citation under your character of *Asplenium vespertinum*, viz., 'Cajon Pass (San Bernardino County,) near San Diego Mission.' Cajon Pass, in this [San Bernardino] county, is 100 miles from San Diego; but there is a Cajon Valley about 20 miles from San Diego, and in that county, which is probably the place intended. Your species belongs to the Coast flora and is not rare on the seaward side of the Coast mountains. At Pasadena it reaches as you note, the San Bernardino range, as do many other of the Coast plants. One or two straggling specimens have been got near San Bernardino."

There can be little doubt that Cajon Valley is the correct locality. The old San Diego Mission referred to stood near the present city of San Diego.



nearer to the midvein than to the margin, the next to the lowermost of the upper row occasionally subdiplazioid; indusia linear, firm, whitish, persistent, irregularly erose; spores light brown, somewhat translucent, conspicuously alate, the ridges sharp and anastomosing coarsely.

Type in the U. S. National Herbarium, no. 427745, collected from ledges above Green River, on the trail from Cinchona to Blue Mountain Peak, Jamaica, at an estimated elevation of 1,050 meters, April 22, 1903, by William R. Maxon (no. 1487).

*Asplenium nesioticum* is apparently confined to Jamaica. It was well characterized by Jenman <sup>1</sup> under the name "*Asplenium ebeneum* Ait." and properly distinguished from its two Jamaica allies, *A. underwoodii* and *A. resiliens*, the "*trichomanes*" and "*parvulum*" respectively of Jenman's treatment. In its mature development it has usually the upright habit, rigid fronds, oblong middle pinnæ, and reflexed lower pinnæ of *A. resiliens*; but it differs from this species conspicuously in its orbicular or flabelliform, noncordate lower pinnæ, its very much longer sori, these placed near the midvein (whereas in *A. resiliens* they are short and near the margin), and by its chaff, this having the apices attenuate but by no means capillary as in *A. resiliens*. Jenman's grounds for associating this plant with Aiton's *A. ebeneum* (*A. platyneuron*) and citing Eaton's plate 4, must remain a matter for speculation, for the two species have no very close relationship. From *A. underwoodii* it differs in nearly all general as well as minute characters. The species is known only from Jamaica.

Besides the type the following specimens have been examined:

JAMAICA: Crevices of wet cliffs, near Green River, on the trail from Cinchona to Blue Mountain Peak, *Maxon* 1493 (N); *Underwood* 2557 (Y), 2561 (Y). Upper slopes of John Crow Peak, in chinks of cliffs in wet woods, *Maxon* 1344 (N); *Underwood* 708 (Y). Old England (below Cinchona), *J. Hart* (N); *Underwood* 1662 (Y). Near Cinchona, alt. 1,500 meters, *Underwood* 2587 (Y). Pleasant Hill, *Harris* 7905 (Y, N). Pleasant Hill Lower Works, August, 1898, *Harris* 7316 <sup>2</sup> (N).

**9. *Asplenium resiliens* Kunze, Linnaea 18: 331. 1844.**

*Asplenium parvulum* Mart. & Gal. Mém. Acad. Sci. Brux. 15<sup>5</sup>: 60. 1842, not Hook. 1840.

TYPE LOCALITY: Near Capulalpan and Hacienda del Carmen, eastern Oaxaca, Mexico, altitude 1,800 to 2,100 meters (*Galeotti* 6462).

DISTRIBUTION: Virginia to Kansas, south to Florida, the Gulf States, Arizona, and in the mountains sparingly through Mexico to Guatemala; also in Jamaica.

ILLUSTRATIONS: Mém. Acad. Sci. Brux. 15<sup>5</sup>: pl. 15. f. 3; D. C. Eaton, Ferns, N. Amer. 1: pl. 36. f. 5, 6; Waters, Ferns 143 (text figure).

Specimens of the type collection of this species have not been seen by the writer. Agreeing very well, however, with the original description by Martens and Galeotti, and with the sketch figure published by them, are certain Mexican specimens which may safely be taken as representing this species; for example, Dr. Edward Palmer's no. 446, collected in 1902, from narrow chinks of shaded cliffs at Alvarez, San Luis Potosí, altitude about 2,400 meters. These specimens are exceedingly fertile and the fronds are narrow and stiffly erect, with auriculate and mainly retrorse segments. A large proportion of the United States specimens are less rigid and a little more leafy; but others from the Southwestern States and the Mexican boundary region are practically identical with the Mexican.

<sup>1</sup> Bull. Bot. Dept. Jamaica 46: 8. 1893.

<sup>2</sup> By an unfortunate interchange of labels plants of this collection in the Jenman Herbarium at the N. Y. Botanical Garden bear Mr. Harris's number 7325 and the locality as New Haven Gap, Jamaica. Mr. Harris writes that these are data actually pertaining to *Histiopteris incisa*, as collected by him.



In the original description the margins of the pinnæ are mentioned as entire, which is by no means invariably true. In a majority of specimens they are nearly entire, and the leaf tissue is so coriaceous that, unless rather strongly cut, the slightly revolute margins commonly appear to be entire or subentire. But in other specimens they are crenulate, or even deeply crenate in unusually luxuriant plants which may have grown in deep shade or under exceptional conditions. The veins, excepting the lowermost superior one (which is several times forked), are mostly once-forked, the sorus commonly being borne altogether upon the anterior branch. The sori are thus, on account of their origin, short and as a rule situated nearer to the margin than to the midvein. With age they are readily confluent, forming a broad marginal band around the pinnæ, or even completely covering the under surface.

The name *Asplenium resiliens*, which is the one under which this species must be known, was given by Kunze solely to replace the untenable name *A. parvulum* Mart. & Gal. (1842), which is invalidated by *A. parvulum* Hook. (1840). This fact, which was pointed out by the writer in 1902<sup>1</sup> and recognized by Mr. Gilbert in his discussion of *A. muticum*,<sup>2</sup> was yet disregarded by him in his later notes upon that species,<sup>3</sup> when he suggested that "*parvulum*" and "*resiliens*" may represent two different forms or even species. As a matter of fact, *A. resiliens* is, within well established limits, a variable species, but hardly more so than a majority of those ferns which occupy equally extensive ranges. In this case the points of difference are not correlated with geographic distribution, as Mr. Gilbert erroneously surmised from his meager material.

This species has been well described repeatedly of late. Besides the difference in marginal form there is considerable variation in the shape of the pinnæ. Those of the middle part of the frond are commonly oblong and auriculate only at the upper side of the base; but occasionally (for example, in Arkansas specimens collected by Mr. James H. Ferriss) they are strongly auriculate both above and below, a form which is usual in the shorter dwindling lower pinnæ of most specimens. The largest individuals seen are plants collected near Blount Springs, Alabama, by John Donnell Smith, in 1884, measuring 35 cm. in height. The species is a common one in the southern United States and apparently prefers limestone.

The specimens examined, omitting those from the United States, are as follows:

MEXICO: Soledad, 25 miles southwest of Monclova, Coahuila, *Palmer* 1435 in 1880 (N, E, M). Monte Albán, near Oaxaca City, Oaxaca, alt. 1,650 to 1,800 meters, *C. L. Smith* 2036, as *A. trichomanes* (M, N). Orizaba, *J. G. Smith* (M, N). Chinks of shaded cliffs Alvarez, San Luis Potosí, alt. 2,400 meters, *Palmer* 446 in 1902 (N). Rocky banks near Tierra Blanca, Chiapas, *Collins & Doyle* 129 (N). Chiapas, *Ghiesbreght* (E). Sierra Madre, near Monterey, Nuevo León, June 8, 1888, *Pringle* (P).

GUATEMALA: San Miguel Uspantán, Dept. Quiché, alt. 1,800 meters, *Heyde & Lux* (*J. D. Smith* 3261) (N).

JAMAICA: Without locality, *Hart* 59 (N). Near Cinchona, alt. 1,500 meters, *Harris* 7899 (Y), 7903 (Y); *Clute* 99 (N). Portland Gap, *Bot. Dept. Coll.* 7904 (Y). Abbey Green, *Bot. Dept. Coll.* 7900 (Y); *Maxon* 1396 (N); *Maxon* 1408 (N). John Crow Peak, alt. 1,800 meters, *Harris* 9702 (Y); *Hart* (N). Several localities, *Underwood* 925, 926, 927, 1194, 2521 (all in Y).

10. *Asplenium palmeri* Maxon, Contr. U. S. Nat. Herb. 13: 39. 1909.

TYPE LOCALITY: Shaded mountain near Etzatlan, State of Jalisco, Mexico, October 2, 1903 (*Rose & Painter* 7582).

<sup>1</sup> Fern Bull. 10: 46. 1902.

<sup>2</sup> Amer. Bot. 4: 86. May, 1903.

<sup>3</sup> Fern Bull. 11: 77-79. July, 1903.



**DISTRIBUTION:** Widely distributed in Mexico; also in Petén and Alta Verapaz, Guatemala.

*Asplenium palmeri* is unique among the species of this group in the prolonged naked apices of its fronds, the ends proliferous, rooting, and often bearing young plants. The specimens examined have previously been cited.

**11. *Asplenium extensum* Fée, Mém. Foug. 7:51. 1857.**

**TYPE LOCALITY:** Ocaña, Colombia (*Schlim* 629).

**DISTRIBUTION:** Colombia and Peru.

**ILLUSTRATION:** Fée, loc. cit. *pl.* 13. *f.* 2, representing the type specimen.

Although no specimens of *Asplenium extensum* have been seen by the writer, it is possible to here include this species because of its marked peculiarities, as shown by Fée's very complete figures. It has been reported from Peru recently by Hieronymus,<sup>1</sup> though it appears to have been unknown to Sodiro<sup>2</sup> as occurring in Ecuador. Mettenius has redescribed<sup>3</sup> it upon the basis of Fée's illustration.

**12. *Asplenium castaneum* Schlecht. & Cham. Linnaea 5: 611. 1830.**

FIGURES 5, 6, 7.

*Asplenium rubinum* Davenp. Bot. Gaz. 19: 391. 1894.

*Asplenium trichomanes* var. *castanea* Hieron. Bot. Jahrb. Engler 34: 459. 1905.

**TYPE LOCALITY:** Mount Orizaba, Mexico (*Schiede & Deppe*).

**DISTRIBUTION:** High mountains and volcanoes of Mexico and western Guatemala to Peru and Bolivia, ascending to 4,500 meters.

The failure of Hooker and several later writers upon ferns to recognize *Asplenium castaneum* as a species amply distinct from *A. trichomanes* may be attributed partly to a want of complete material and in greater part to the prevalence of a different conception of species limits; but that this confusion should have persisted till now is rather remarkable. Thus, *Asplenium trichomanes* is mentioned by a recent American writer<sup>4</sup> as one of several species of the northeastern United States which extend far southward, this species in particular being found "above 3,350 meters" upon the Volcan de Fuego, Guatemala. *Asplenium trichomanes*, however, barely reaches northern Mexico, and the Guatemalan plant in question is *A. castaneum*. Recently also Hieronymus,<sup>5</sup> notwithstanding his exact and highly painstaking work upon the Pteridophyta in general, has regarded *A. castaneum* as a variety of *A. trichomanes*; although its greater size and more sturdy habit, as well as the delicate, large, brown scales of the rhizome, the very stout, fibrillose stipes, the large pinnæ, and the very large and broad, erose indusia should suffice to differentiate it at once as a distinct species.

Mr. Davenport, who was loth to describe new species, holding always to a very broad concept of specific limits, had no doubt of the distinctness of this plant, though he seems not to have known of the application of the name *castaneum*. In describing this species as *A. rubinum* he compares it with *A. trichomanes*, remarking that "once seen it is not likely to be mistaken for any other known species." The type of *rubinum* is Mr. Pringle's no. 5191, from the Sierra de las Cruces, State of Mexico. This and Mr. Pringle's no. 6150, collected later at the same locality, are perfectly characteristic of *A. castaneum*, and include plants of two different sorts: (1) Specimens which are stout and exceedingly fertile, the pinnæ nearly medial in attachment and having usually 4 or 5 pairs of crowded sori to each; and (2) others which are only partially fertile, having the pinnæ trapeziform-oblong in outline, mostly attached at the proximal point of

<sup>1</sup> Hedwigia 47: 223. 1908.

<sup>2</sup> Sodiro, Crypt. Vasc. Quit. 143. 1893.

<sup>3</sup> Abh. Senckenb. Ges. Frankfurt 3: 182. 1860.

<sup>4</sup> Rhodora 10: 20. 1908.

<sup>5</sup> Bot. Jahrb. Engler 34: 459. 1905.



the inner margin and bearing only 3 or 4 sori each. The first is shown in figure 5; the second in figure 6. In minute characters the two plants are identical, and a similarly pronounced variation in leaf form, venation, and fertility is observed in specimens from other localities, notably in a series collected by the writer at the summit of the Volcano Agua. The thin, flaccid, transparent, reticulate, dull-brownish scales, which are both conspicuous and numerous, are characteristic (see fig. 7). From the exceedingly fertile, high-mountain form of *A. monanthæ*, which is sometimes known as *A. polyphyllum* Bertol. (shown in pl. 1, figs. *h*, *i*, *k*), *A. castaneum* may be distinguished readily by its relatively broader and differently shaped pinnæ, by its shorter and broader, decidedly erose indusia, and by the different character of the rhizome scales. It has been fully described by Mettenius<sup>1</sup> and it is not likely to be confused with any other American species.

The following specimens of *A. castaneum* have been examined:

MEXICO: Subalpine region of Mount Orizaba, among rocks, March, 1908, *Purpus* (N). Same locality, *Rose & Hay* 5746 (N). Same locality, alt. about 4,270 meters, *Seaton* 245 (N, G). Same locality, alt. about 3,300 meters, *Seaton* 163 in small part (N). Same locality, alt. 4,500 meters, *Jared G. Smith* 90 (N). Mount Popocatepetl, alt. about 3,600 meters, *Rose & Hay* 5988 (N). Mount Ixtaccihuatl, among rocks, alt. 3,050 to 3,350 meters, *Purpus* 226 (N). Volcano of Colima, Jalisco, *Jones* 526 (N). Sierra de las Cruces, State of Mexico, alt. 3,650 meters, *Pringle* 5191 (P, G). Same locality, *Pringle* 6150 (G, M, N, Y, P, Gilbert). Nevada de Toluca, State of Mexico, alt. 3,080 to 3,230 meters, *Rose & Painter* 7943 (N).

GUATEMALA: Volcan de Agua, crevices of cliffs near the summit, alt. 3,750 meters, *J. D. Smith* 2446 (N); *J. D. Smith* 2449 (G, N, Y); *Maxon & Hay* 3696 (N). Same locality, in crevices of rocks, lower rim of crater, *Maxon & Hay* 3697 (N). Volcano Atitlan, Dept. Sololá, *Kellerman* 5795 in part (N). Top of Volcan de Fuego, *Salvin & Godman* 225 (G).

PANAMA: Rocks near El Potrero Camp, Chiriqui Volcano, alt. 2,890 meters, *Maxon* 5326 (N). Near summit of Chiriqui Volcano, alt. about 3,300 meters, *Maxon* 5367 (N).

PERU: Obragilla, *Wilkes Expedition* (N).

ECUADOR: Without locality, *Sodirol* (N, Y).

BOLIVIA: Unduavi, alt. about 3,050 meters, *Rusby* 407, as *A. extensum* (N, Y).

13. *Asplenium formosum* Willd. Sp. Pl. 5: 329. 1810.

? *Asplenium nanum* Willd. Sp. Pl. 5: 323. 1810.

*Asplenium subalatum* Hook. & Arn. Bot. Beechey Voy. 312. 1840.

*Asplenium formosum*  $\beta$  *subalatum* Moore, Ind. Fil. 133. 1859.

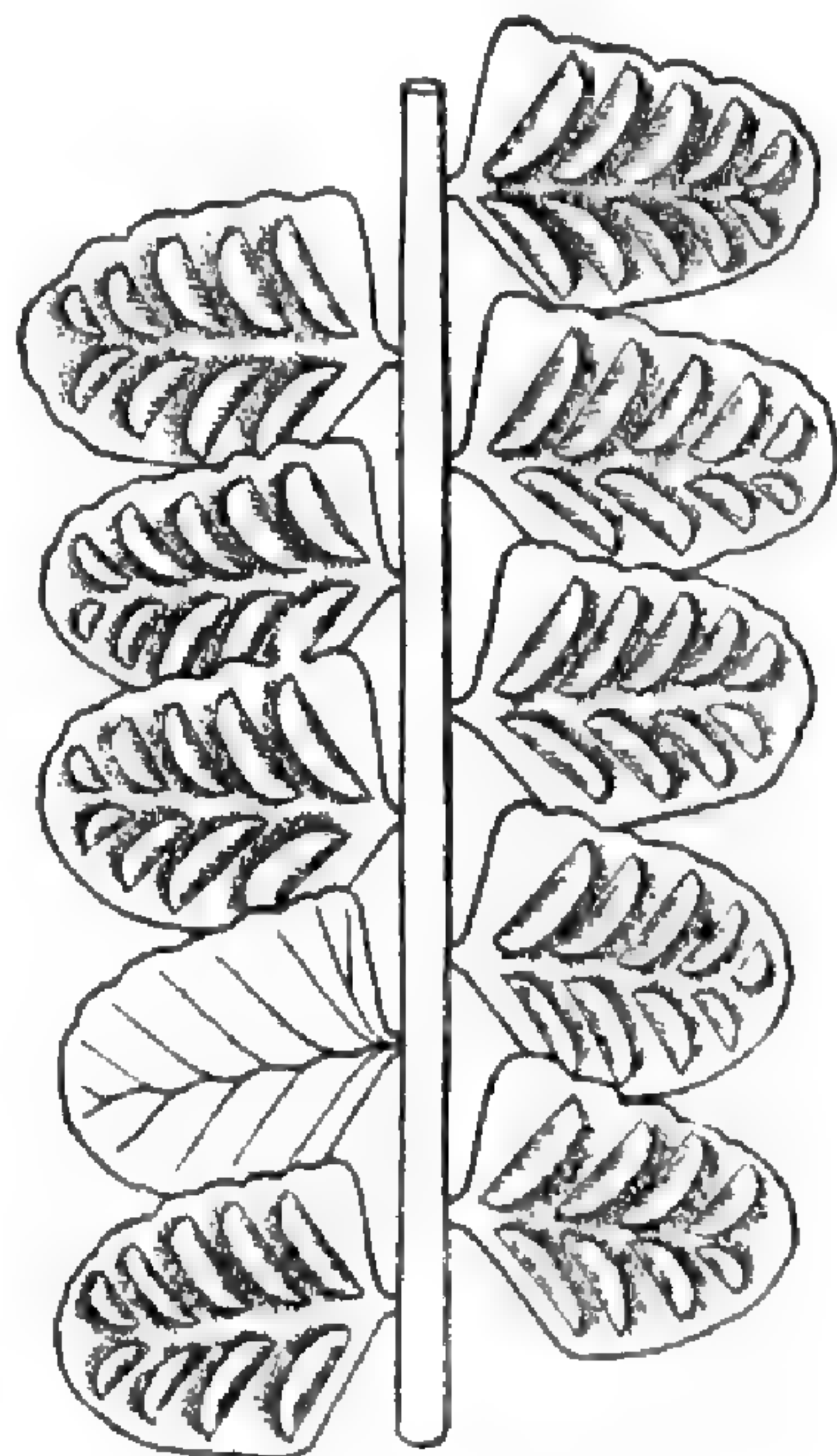


FIG. 5.—*Asplenium castaneum*.  
Pringle's 6150. Scale 2.

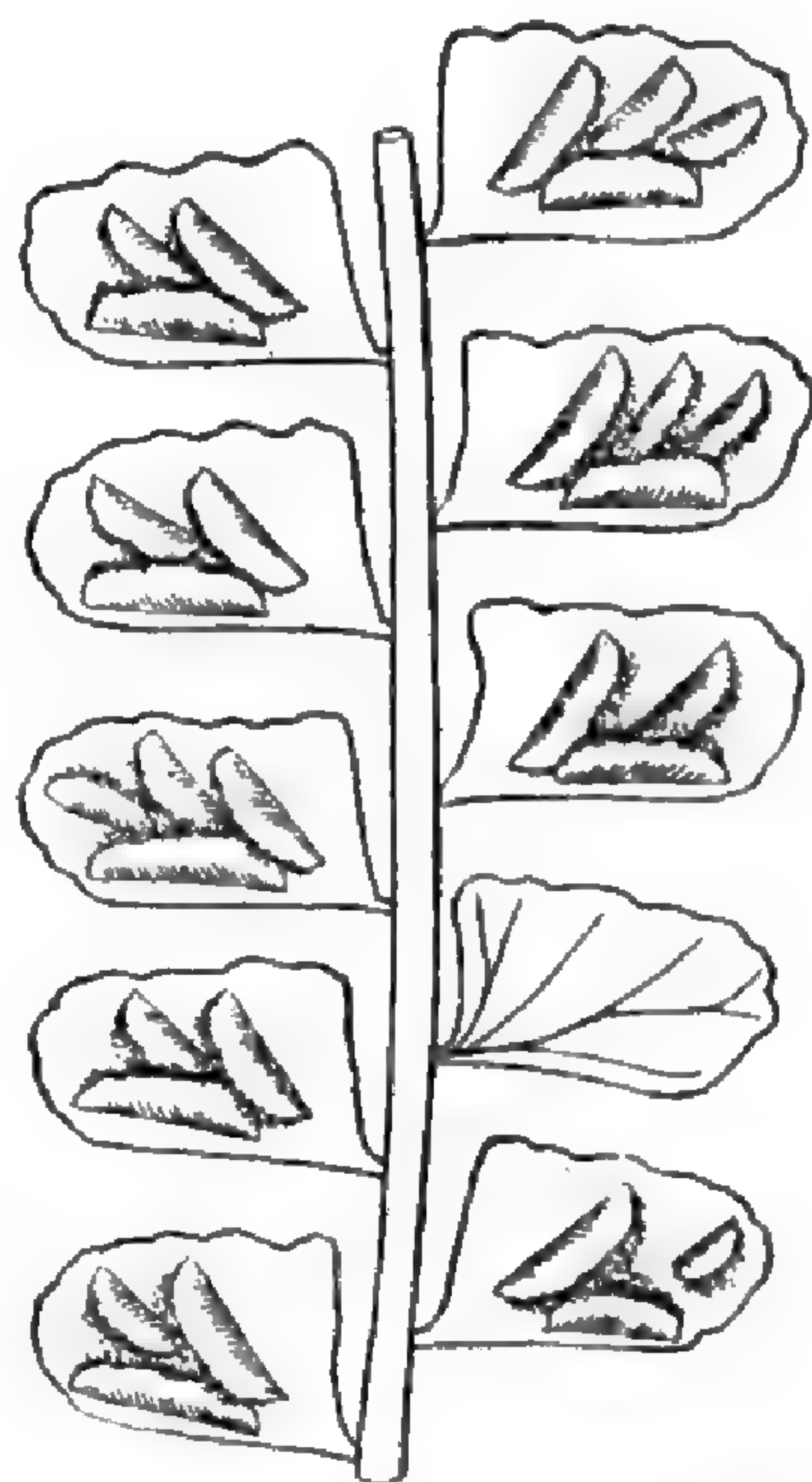


FIG. 6.—*Asplenium castaneum*.  
Pringle's 6150. Scale 2.

<sup>1</sup> Abh. Senckenb. Ges. Frankfurt 3: 181. 1860.



**TYPE LOCALITY:** Shady woods near Caracas, Venezuela (*Bredemeyer*).

**DISTRIBUTION:** General in tropical America, being widely dispersed in the West Indies and extending on the continent from Mexico to Bolivia and Brazil. It occurs also in southern India, Ceylon, and tropical Africa.

**ILLUSTRATIONS:** Hook. & Arn. loc. cit. pl. 71 (as *A. subalatum*); ? Plum. Trait. Foug. pl. 66. f. B.; Hook. Exot. Ferns pl. 16.

This, which is the commonest species of the *trichomanes* group in tropical America, is well known and shows comparatively little variation. It is remarkable for the almost uniform position of its few sori upon the proximal side of the pinnæ and for the lacinate character of the upper margins. Plate 16 of the Exotic Ferns shows an extreme condition, in which the sori are numerous and paired, somewhat as in *A. carolinum*; but the specimen figured was doubtless taken from cultivation at Kew and is not typical. In the specimens cited below the occurrence of any sori at all upon the distal side of the pinnæ is decidedly unusual and the cutting of the pinnæ is very different from that of *A. carolinum*, as explained under that species.

*Asplenium subalatum* Hook. & Arn., the type of which is from Tepic, Mexico, differs in no respect from the usual form of *A. formosum*, as may be ascertained from the excellent plate. Plumier's figure, cited above with doubt, possibly represents this species as known to him from a small Martinique specimen. In this case the name *nanum*, having page priority over *formosum*, would technically have to replace the latter well-known name.

*Asplenium formosum* occurs usually, if not invariably, along watercourses, either upon rocky or solid earth banks. It is commonest at low or middle elevations (150 to 900 meters), but in Bolivia ascends to 1,800 meters. The following specimens (localities and habitat data here omitted) are in the U. S. National Herbarium:

JAMAICA: *Fredholm* 3255; *Clute* 279; *Maxon* 781, 825.

CUBA: *Wright* 854; *Britton, Earle & Wilson* 4733; *Shafer* 538; *Maxon* 3923.

HAYTI: *Nash & Taylor* 1222, 1346.

PORTO RICO: *Britton & Marble* 472; *Sintenis* 414.

DOMINICA: *Eggers* 844.

GUADELOUPE: *Duss* 4123, 4202.

MARTINIQUE: *Duss* 1651.

MONTSERRAT: *Turner*.

MEXICO: *Galeotti* 6471; *Langlassé* 350; *Jones* 527; *Rose & Painter* 6944; *Orcutt* 4638; *Purpus* 2178; *Liebmann*.

BRITISH HONDURAS: *Blancaneaux*.

GUATEMALA: *Heyde* 214; *Cook & Griggs* 673; *Deam* 6079; *John Donnell Smith* 1065 (*von Türckheim*), 1176 (*Walker*), 2444 (*J. D. S.*), 3222 (*Heyde & Lux*).

HONDURAS: *John Donnell Smith* 5678 (*Thieme*).

NICARAGUA: *Wright*.

COSTA RICA: *Cook & Doyle* 244; *Hitchcock* 8446a, 8458a; *Pittier* 914, 3070, 4446; *Tonduz* 8799, 9456, 12751; *Maxon* 582.

PANAMA: *Maxon* 4671; *Pittier* 4478.

COLOMBIA: *Lehmann* 6015; *H. H. Smith* 966.

VENEZUELA: *Fendler* 133.

BOLIVIA: *Williams* 1074, 1075.

BRAZIL: São Paulo, *Regnell* I 487; *Ulbricht*.

CEYLON: *Ex herb. Hope*.

NYASALAND: *Buchanan* 258.

KAMERUN: *Zenker & Staudt* 642.



FIG. 7. — *Asplenium castaneum*. Rhizome scales. Pringle's 6150. Scale 8.



**14. *Asplenium carolinum* Maxon, sp. nov.**

Rhizome erect or ascending, woody, about 5 mm. in diameter, somewhat sheathed by the persistent stipe bases of old fronds, the crown obscurely paleaceous, the scales rigid, linear-lanceolate, 1.5 to 2.5 mm. long, yellowish brown with a distinct dark brown median stripe; fronds 8 to 12, 10 to 20 cm. long, ascending, borne in a close vasi-form crown; stipes short, stoutish (1 mm. thick or less), subterete, the anterior face narrowly sulcate, the ridges noticeably alate; lamina narrowly linear-oblongate, 8 to 18 cm. long, 1.2 to 2 cm. broad, pinnate, rather abruptly acute at the apex, the lower portion more gradually reduced; pinnæ numerous, spreading, distant to adjacent, the lower ones deltoid, deeply parted, the lowermost minute; middle pinnæ 7 to 10 mm. long, 3 to 4 mm. broad, oblong from a broadly cuneate or subrectangular base, subauriculate by the incision of the upper margin near the base, the auricle or lobe distinctly 2 to 4 dentate, the upper margin elsewhere more or less deeply crenate-serrate or obliquely incised (the crenations simple or faintly bidentate), the lower margin entire in the proximal half, obliquely crenate toward the apex; veins 4 to 6 pairs, very oblique, the superior basal one 1 to 3 times forked, the others simple or (in the case of the larger bidentate crenations) forked at a very acute angle, all nearly concealed; sori 2 or 3 pairs, borne in the outer half or two-thirds of the pinna, elliptical, tumid, very oblique; indusia firm, ample, subentire. Leaf tissue firmly chartaceous, dull dark green, the lower surface minutely puberulent.

Type in the U. S. National Herbarium, no. 25611, collected upon Charles Island, one of the Galapagos group, by Leslie A. Lee, April 8, 1888, during the voyage of the U. S. Bureau of Fisheries Steamer *Albatross* (1887-1888).

Specimens which presumably are of this species have hitherto been reported from the Galapagos Islands as *Asplenium formosum*, of which *A. carolinum* is a close ally. This species differs from *A. formosum* principally in its obtuse and less deeply incised pinnæ, in having the crenations of the pinnæ simple or faintly dentate (instead of deeply and sharply cleft), and in its shorter and less oblique sori which are arranged in pairs, instead of in a single series upon the proximal side of the pinnæ. In all probability *Asplenium carolinum* is a derivative of *A. formosum* and the differences noted are doubtless to be associated with its isolation far from the mainland.

**15. *Asplenium platyneuron* (L.) Oakes; D. C. Eaton, Ferns N. Amer. 1: 24. 1878.**

*Acrostichum platyneuros* L. Sp. Pl. 1069. 1753, in part.

*Asplenium ebenum* Ait. Hort. Kew. 3: 462. 1789.

*Asplenium trichomanoides* Michx. Fl. Bor. Amer. 2: 265. 1803.

*Asplenium polypodioides* Swartz, Journ. Bot. Schrad. 1800<sup>2</sup>: 53. 1801.

TYPE LOCALITY: Virginia.

DISTRIBUTION: Maine and southern Ontario to Florida, westward to Texas and Colorado. Also in South Africa.

ILLUSTRATIONS: Schkuhr, Krypt. Gewächse. 1: pl. 73 (as *Asplenium polypodioides*); D. C. Eaton, loc. cit. 1: pl. 4. f. 1 (as *Asplenium ebenum*); Williamson, Ferns Kentucky pl. 17.

Among the species of this group *Asplenium platyneuron* is unique in having the fertile and sterile fronds very unlike each other in both form and stature. The relatively short sterile fronds (which are evergreen) form a basal rosette, radiating from the rhizome and lying close to the ground. The fertile fronds are tall and fewer in number and are borne stiffly erect from the center of the rosette. There is a good deal of variation in the degree of serration of the pinnæ, and several varietal forms have been described, one of the most pronounced being the variety *hortonae*, of New England. This has the pinnæ deeply pinnatifid, and in its extreme form is sterile. Plants with pinnæ irregularly and often deeply incised are not at all uncommon, especially in the southern United States, but these are only extremes of a tendency which may be noted in any region where this species is abundant, and numerous specimens occur which are intermediate in every respect.



Eaton's excellent plate should serve to identify this species without doubt. Nevertheless, Jenman, though citing it, has applied the name "*Asplenium ebeneum* Ait." to the very dissimilar Jamaican plant here described as *A. nesioticum*, as shown not only by his description but by specimens of the Jenman collection at the New York Botanical Garden. Sodiro also has erroneously applied the same name to certain specimens from the Andes of South America which have been regarded by Doctor Christ as a new species, *A. sodiroi*;<sup>1</sup> but additional specimens collected in Costa Rica by Tonduz (no. 12333) and included by Doctor Christ have herbaceous green stipes and clearly fall outside the limits of the *A. trichomanes* group. The South American element has not been seen by the writer.

The occurrence of *A. platyneuron* in South Africa gives this species a distribution which, while unusual, is not unprecedented; and specimens at hand from that region seem to be identical with the United States plant. Few of the species of this group are less exacting in requirements of habitat. It is often plentiful at the edge of moist, rich, rocky woods, but will be found again upon open sandy hillsides or less commonly in the chinks of cliffs of various formations. It appears to attain its best development along partially shaded or rather open rocky banks, often flourishing in large colonies among grasses and the rank growth of late summer. Photographs showing it in its natural surroundings, as well as illustrations of herbarium specimens, have been published in several books dealing with the ferns of the United States in a popular way within recent years. *Asplenium trichomanes* has been similarly treated.

Some doubt may reasonably be expressed as to the desirability of going back to the Species Plantarum of Linnæus for the species name *platyneuron*. The figures there cited under *Acrostichum platyneuros* pertain to *Polypodium vulgare* or *P. polypodioides*, and the only *Asplenium* element mentioned is contained in Gronovius's brief character:<sup>2</sup> ASCROSTICUM *frondibus alternatim pinnatis, foliolis ovatis crenatis sessilibus, sursum arcuatis*. Clayton's description, cited by Gronovius, is even briefer: *Trichomanes foliis minoribus, caule nigro splendente*; but as applied to a Virginia plant it describes an *Asplenium* rather than a *Polypodium*, and so may actually relate to the plant long known as *Asplenium ebeneum*. Eaton<sup>3</sup> is authority for the statement that this species is not represented in the Linnæan herbarium under the name *Acrostichum platyneuros*. Clayton's plant, cited by Gronovius, should be in the British Museum; but Mr. A. Gepp, who has been good enough to search for it, states that it is not now to be found, although there is a Gronovian specimen rightly named and marked as coming from Carolina. This was probably the basis of Gronovius's description, adopted bodily by Linnæus (who published no description of his own), and so may stand as the type of *Acrostichum platyneuros*.

The later synonymy as cited above appears to be complete. Michaux's description of *A. trichomanoides*, though inadequate, seems to apply to *A. platyneuron*, as both Moore and Eaton have claimed. The amended description by Kunze,<sup>4</sup> however, almost certainly applies to *A. resiliens*.

#### 16. *Asplenium denudatum* Mett.; Kuhn, *Linnaea* 36: 93. 1869.

TYPE LOCALITY: "Andes Peruvianae," the exact locality and collector's name not stated.

DISTRIBUTION: Mountains of Peru and Ecuador.

This species is known to the writer from a single imperfect specimen, this agreeing in nearly every particular with the original description. Superficially, in the shape of the pinnæ and character of the sori, it resembles *A. monanthes* rather closely, and

<sup>1</sup> Christ in Pittier, *Prim. Fl. Costar.* 3: 26. 1901.

<sup>2</sup> Gronov. *Fl. Virg.* 123. 1739.

<sup>3</sup> *Canad. Nat.* 13: 25. 1870.

<sup>4</sup> *Amer. Journ. Sci.* 6: 85. 1848.



badly abraded specimens lacking a rhizome probably could not always be distinguished from that species. The most distinctive points, both mentioned in the original description, are (1) the ferruginous rhizome scales and (2) the long articulate glandular-capitate hairs of the rachis. The first at once differentiates *A. denudatum* from all other species of this group, including *A. monanthes* which in all its forms has black or brownish scales. The second character also, though apparent only upon close examination, is nearly peculiar to this species, hairs very similar to these having been observed only upon several specimens of *A. castaneum*.

The following specimen, consisting of two fronds in the U. S. National Herbarium, is too incomplete to afford full data as to the usual position and arrangement of the sori:

ECUADOR: Without definite locality, *Jameson*.

**17. *Asplenium monanthes* L. Mant. Pl. 1: 130. 1767.**

PLATE 1.

*Asplenium monanthemum* L. f.; Murray, Syst. Veg. 933. 1784.

*Asplenium dentex* von Buch, Besch. Canar. Ins. 189. 1825.

*Asplenium menziesii* Hook. & Grev. Icon. Fil. 1: pl. 100. 1829.

*Asplenium polyphyllum* Bertol. Nov. Comm. Acad. Bonon. 4: 443. 1840, not Presl ex Goldman, 1843.

*Asplenium arcuatum* Liebm. Dansk. Vid. Selsk. Skrivt. V. 1: 241. 1849.

*Asplenium galeottii* Fée, Gen. Fil. 192. 1852.

*Asplenium leptophyllum* Fée, Mém. Foug. 7: 50. 1857, not Swartz, 1791, nor Lag. 1802.

*Asplenium blandulum* Fée, Mém. Foug. 7: 51. 1857.

*Asplenium polymeris* Moore, Ind. Fil. 154. 1859.

*Asplenium bertolonii* Donn. Smith, Enum. Pl. Guat. 4: 189. 1895.

*Asplenium trichomanes* var. *viridissimum* Christ, Bull. Soc. Bot. Belg. 35: 195. 1896.

*Asplenium viridissimum* Bommer, Bull. Soc. Bot. Belg. 35: 195. 1896, as synonym.

TYPE LOCALITY: South Africa.

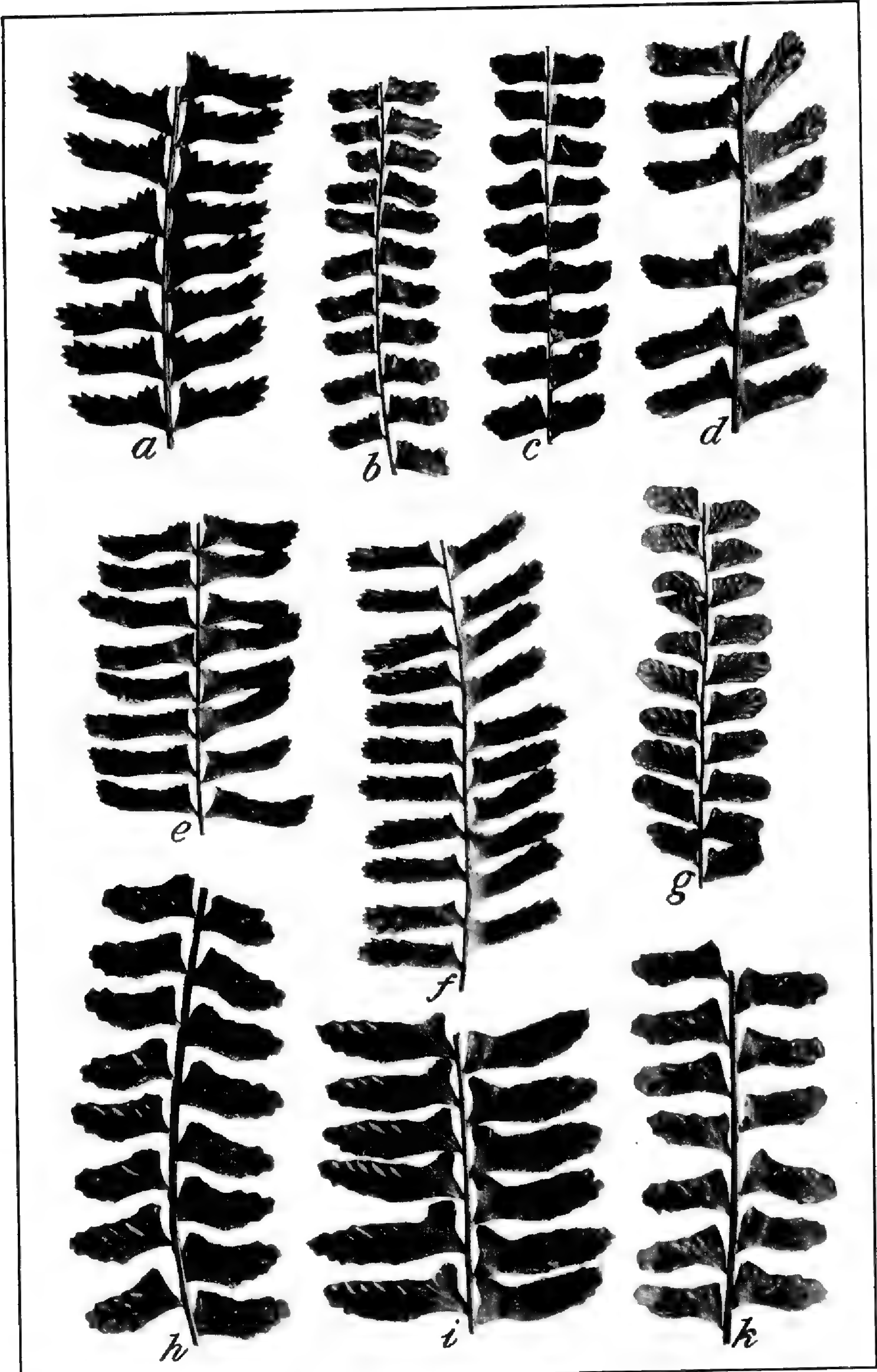
DISTRIBUTION: Widely dispersed in Africa, including the Atlantic islands; upon the American continent extending from the Huachuca Mountains, Arizona, through Mexico and Central America to Chili; also in Jamaica and the Hawaiian Islands.

ILLUSTRATIONS: Lowe, Ferns Brit. Exot. 5: pl. 1. *A* (as *A. dentex*); Brack. in Wilkes, U. S. Expl. Exped. 16: pl. 20. f. 2 (as *A. monanthemum*); Mett. Fil. Hort. Lips. pl. 9. f. 7, 8 (as *A. monanthemum*); Fée, Mém. Foug. 7: pl. 16. f. 2 (as *A. galeottii*); Fée, loc. cit. 7: pl. 14. f. 2 (as *A. leptophyllum*).

The above synonymy, which is probably not complete, relates to the most variable species of this group and serves to indicate how many of its phases have been regarded as distinct species. The diversity of form is very great, and it is surprising, considering the wide geographical range, that no definite and recognizable lines of cleavage should have developed, separating its more isolated elements finally into obviously distinct species. The recognition of its forms even as subspecies seems rather undesirable, since in most cases they do not appear to occupy separate areas and because their extremes are for the most part apparently connected by numerous intermediates. Local conditions of environment seem to be unusually potent in determining size and fertility of individual plants and, consequently, size and shape of pinnæ. The species is especially subject to variation in character and extent of soriation, and an exceedingly interesting detailed morphological study might advantageously be made of this phase alone in its relation to leaf form and habitat. A few descriptive notes are here given, mainly in connection with the above synonymy.

The type of *Asplenium monanthes* is from the Cape of Good Hope, and though the original diagnosis refers to the sorus as single and lying close to the lower margin neither of these characters is invariably true of South African material nor of plants from any other single region. (Two different collections from Natal and one from Madagascar are shown in pl. 1, figs. *a*, *b*, and *c*.) Plants with a single long sorus or





FORMS OF ASPLENium MONANTHES L.



with a few sori near the lower margin usually come from dry bushy banks or open slopes, and are likely to have very narrow stiff fronds. According to Milde and others, the species is rather widely distributed in Africa. Specimens are at hand from Madagascar, Natal, German East Africa, and British East Africa, as well as from several of the Canaries and neighboring islands. *Asplenium dentex* was described from the Canaries and *A. blandulum* from the Cape Verde group. *Asplenium menziesii* is a name given by Hooker and Greville to the Hawaiian form of this species, but their description and plate have been held to apply equally well to South American specimens, which have been regarded as at most a variety of *A. monanthes*.

The two American species proposed by Fée are forms which at first appear sufficiently distinct. *Asplenium leptophyllum* was founded upon plants collected in Colombia by Schlim and in Mexico by Galeotti. These, as figured, will be seen to represent one of the common Mexican forms not unlike that which occurs in Arizona. *Asplenium galeottii* was founded upon specimens collected in Oaxaca by Galeotti (no. 6369). It is not common in Mexico, but occurs in both eastern and western Guatemala and in Costa Rica, and presumably also in the high mountains of the intervening territory. Intermediates between Fée's two "species" are of frequent occurrence, as, for example, the Guatemalan plant shown in plate 1, figure *d*, and the Mexican plant shown in plate 1, figure *e*.

Another Mexican form which has been collected by Palmer, Pringle, and others<sup>1</sup> is that illustrated in plate 1, figure *f*. This has the characteristic middle pinnae linear-oblong, 12 to 17 mm. long, subauriculate, the auricular portion sharply dentate-serrate, the serrations usually becoming more oblique and continuing around the otherwise blunt apex, being noticeable upon the lower margin fully half the distance toward the base. The sori are rather short and arranged in 3 to 5 pairs, the upper line of sori usually being nearly as complete as the lower. This form was regarded by so careful a field observer as Mr. Pringle as representing a species distinct from *A. monanthes*. Specimens are at hand, however, representing a complete transition into the form called *A. leptophyllum* by Fée. *Asplenium arcuatum* represents one of these intermediates, as is proved by several fronds of Liebmann's original specimens received from Copenhagen.

Still another Mexican form is that indicated in plate 1, figure *g*. It is not very common and is chiefly remarkable for its congested appearance, largely owing to the sori being numerous, long, and close-set, nearly covering the surface of the pinnae.

The most remarkable phase of all is that found upon several of the high volcanoes of western Guatemala and Costa Rica. This was first described under the name *Asplenium polyphyllum*<sup>2</sup> by Bertoloni in 1840 from the volcano Agua, Guatemala. Specimens from the type locality, where it is abundant<sup>3</sup> in the moist forested zone

<sup>1</sup> Rio Blanco, State of Jalisco, *E. Palmer* 562, in 1886; cool banks, Eslaba, Federal District, *Pringle* 8754; Santa Rosa, Guanajuato, *Dugès* 25, in 1905.

<sup>2</sup> *Asplenium polyphyllum* Presl, relating to plants from Manila and Oahu, was published as a *nomen nudum* in 1836 and was not associated with a description until 1843 (Goldman in Nov. Act. Acad. Caes. Leop. Carol. 19: Suppl. 1: 462. 1843). In the meantime (in 1840) Bertoloni had fully described a Guatemalan plant under this name. There was thus no need of the new name *A. polymeris* published by Moore for the Guatemalan plant in 1859. Captain Smith also renamed the Guatemalan plant *A. bertolonii*, presumably upon the same ground erroneously taken by Moore, namely, that the name *polyphyllum* must date from 1836.

<sup>3</sup> The following specimens are in the U. S. National Museum: Volcan de Agua, Guatemala, alt. 2,700 to 3,300 meters, in moist shaded thickets or rarely on shaded banks, *Maxon & Hay* 3674, 3725, 3729, 3732, 3733, 3733a, 3734, 3737, 3741; *John Donnell Smith* 2447. The same form was also collected in the Department of Quiché, Guatemala, above 3,000 meters by Heyde and Lux and distributed by Captain Smith as no. 3225.



between 2,700 and 3,300 meters, are figured in plate 1, figures *h*, *i*. Similar specimens from the Volcano Barba, Costa Rica (*Pittier* 1937), shown in plate 1, figure *k*, were regarded by Bommer as a valid species, *Asplenium viridissimum*, and were described by Christ as *A. trichomanes* var. *viridissimum*. These plants of the high mountains of Guatemala and Costa Rica represent in most respects the highest development of the species. Many of the individuals are more than a meter tall, the fronds usually numerous and closely imbricate upon a stoutish suberect rhizome, the rachises stout (from 1.5 to 2.5 mm. in diameter) and strongly winged upon the upper side. The pinnæ are numerous (60 to 80 pairs), the middle ones mostly oblong to narrowly oblong from a strongly inequilateral often narrowly cuneate base, strongly auriculate above, the lower side evenly excised about half the distance to the rounded or often subspatulate apex. The margins vary from crenate to lightly crenate-serrate, according to the fertility of the pinnæ. The sori are 4 to 6 pairs in number, oblique, crowded, and borne mainly in pairs throughout, excepting only the auricle which bears none, or rarely more than one sorus. The indusia are firm, whitish, even-margined, and persistent, relatively narrower than in *A. castaneum*, and at maturity are mostly concealed by the masses of dark brown sporangia, which indeed commonly suffuse the whole under surface of the pinnæ. Nearly all the fronds are minutely viviparous near the apex, but no buds have been noted upon the stipe or lower part of the rachis, as is common in ordinary forms of *A. monanthes*.

This form is a striking one, differing very materially from most conditions of *A. monanthes*, and may represent a valid species. It is nearest to the form described as *A. galeottii*, but no true intermediates have been seen. In view of the wide extent of variation existing among the forms which are known positively to belong to *A. monanthes*, however, it scarcely seems desirable to recognize as distinct this Costa Rican and Guatemalan plant, which is only a little more extreme than several other phases. No species retaining the common characters of this group could appear to be more polymorphic than *A. monanthes*; and it is possible that a further investigation may show not only "*A. polyphyllum*" but other of the forms here enumerated and figured to be improperly associated under a single species. The various phases or races are, however, closely allied among themselves and do not merge into any of the species separately listed; so that a future subdivision of *A. monanthes* as here treated need not involve a realignment of the other species.

EXPLANATION OF PLATE 1.—Various forms of *Asplenium monanthes* L.: *a*, specimen from Natal, *Buchanan*; *b*, Mount West, Natal, alt. 960 meters, *Schlechter* 6821; *c*, Madagascar, *Hildebrandt* 3591; *d*, Volcan de Agua, Guatemala, alt. 2,700 to 3,000 meters, *Maxon* 3739; *e*, Teziutlan, Puebla, Mexico, *Orcutt* 3987; *f*, Eslaba, Federal District, Mexico, alt. 2,350 meters, *Pringle* 8754; *g*, near Cima, State of Mexico, *Rose & Painter* 7204; *h*, Volcan de Agua, Guatemala, alt. 2,700 to 3,000 meters, *Maxon* 3733; *i*, same locality, *Maxon* 3732; *k*, Volcan de Barba, Costa Rica, alt. 2756 meters, *Pittier* 1937. All are shown at natural size.

**18. *Asplenium melanorachis* C. Chr. Ind. Fil. 121. 1905.**

*Asplenium nigricans* D. C. Eaton, Proc. Amer. Acad. 8: 619. 1873, not Kunze, 1834.

TYPE LOCALITY: Chiapas, Mexico, on the trunks of large trees, in the borders of forests (*Ghiesbreght* 377).

DISTRIBUTION: Known only from the original collection.

This species was well characterized by Eaton. Its relationship is discussed briefly under the following new species:

**19. *Asplenium kellermanii* Maxon, sp. nov.**

Fronds several, about 50 cm. long, ascending; rhizome erect or suberect, stoutish, obscurely paleaceous, the scales lance-attenuate, opaque, 1.5 to 2 mm. long; stipes stout (about 1.5 mm. in diameter), dark reddish brown, lustrous, nearly terete, 25 to 30 cm. long; lamina narrowly oblong, about 25 cm. long, 5 to 9 cm. broad, simply pinnate, the rachis similar to the stipe, but the upper surface sulcate, narrowly alate; pinnæ 7 or 8 pairs, opposite or subopposite, sessile, subequal, the upper ones scarcely



reduced, the terminal segment conform or sometimes hastate and greatly enlarged; basal pinnæ opposite, deltoid, very broadly and subequally cuneate or nearly truncate, 2 to 2.7 cm. long, about 2 cm. broad; middle pinnæ 3.5 to 4.5 cm. long, 1.5 to 2.5 cm. broad above the broadly cuneate inequilateral base, asymmetrically deltoid or subtrapeziform, the apical portion triangular, acute; margins crenulate, distantly so toward the apex of the pinnæ; venation subflabellate, the basal veins several times dichotomous, the others once or twice forked, very oblique, the branches nearly equal; sori 4 or 5 pairs, linear, 5 to 9 mm. long, very oblique, distinctly inframedial but usually extended along the anterior branch of the vein; indusium linear, about 1 mm. broad, fragile, entire, grayish brown; leaf tissue rigidly herbaceo-chartaceous, dull grayish green, discolored in drying, opaque, the venation distinctly visible only by transmitted light.

Type in the U. S. National Herbarium, no. 691213, collected on the Volcano Atitlán, Department of Sololá, Guatemala, February 16, 1906, by Prof. W. A. Kellerman (no. 5792).

*Asplenium kellermanii* departs very widely from the typical members of the group of *A. trichomanes* and perhaps ought not to be associated with them. It represents, in fact, one extreme of a series containing the large forms of *A. monanthes* as the other extreme, with *A. melanorachis* occupying an almost exactly intermediate position. From *A. melanorachis* it differs conspicuously in the characters enumerated in the key, and also in its paired sori, its subequal pinnæ (the upper ones not or scarcely at all reduced), and in its large terminal segment. *Asplenium melanorachis* itself is specifically distinct from *A. monanthes*, yet in its general habit, elongate-oblong pinnæ, and inferior sori it shows clearly an alliance with that species. It is said by Ghiesbreght to have grown upon the trunks of large trees. *Asplenium kellermanii* is terrestrial.

## THE NORTH AMERICAN TREE FERNS OF THE GENUS DICKSONIA.

In the last paper of this series the writer published a key to the North American species of *Cibotium*, with notes upon the taxonomic history of the several species, which had been very generally confused. Related to *Cibotium* is the genus *Dicksonia*, whose species also have been widely misunderstood. The main differences between the two genera have recently been summarized in a nontechnical article<sup>1</sup> upon the tree ferns of North America. It is there pointed out that in *Dicksonia* the leaf blades are narrowly elongate and either lanceolate or oblanceolate, the lower pinnæ gradually reduced in size, while in *Cibotium* the blades are very much more ample and of a broadly ovate or deltoid type; a feature which is fully as important as the technical distinctions drawn from the indusia. The peculiar bivalvate indusium of the tribe Dicksonieae is also discussed briefly, reference being made to that of *Cibotium* as the most highly differentiated of any of the tribe, since in this genus the outer lip, like the inner, is manifestly cartilaginous. In *Dicksonia*, on the other hand, the outer concave lip consists merely of the leaf tissue of a small marginal lobule of the leaf segment, which is only slightly modified

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<sup>1</sup> Ann. Rep. Smiths. Inst. 1911: 463-491. pls. 1-15. 1912.



by its function as a partial covering for the sporangia. In both these genera, however, the true indusium is the inner yellowish or yellowish brown lip, which is rigidly cartilaginous, that of *Dicksonia* being rounded and more nearly hemispherical than that of *Cibotium*.

In the *Dicksonieae* the species are much more difficult to distinguish than in the tribe *Cyatheae*, partly because there is a less appreciable difference in cut of leaf, and partly from the almost complete absence of special structures (various types of scales and hairs) which serve to distinguish the species of the *Cyatheae*. Moreover, the branching of the veins is more variable and more directly correlated with degrees of fertility. Upon superficial examination merely it would be possible to so arrange the American forms of *Dicksonia* in a single series that they might appear to represent but a single polymorphic "species," with several outlying forms. Thus, to an unusual degree the study of this genus must be a comparative one, dealing with a large series of specimens from as many localities as possible. This is rendered difficult, however, by the fact that the genus is apparently represented in America by few species and that individuals are not only of infrequent occurrence but are found usually in inaccessible heavily forested regions.

But two species of *Dicksonia* have been ascribed to North America in recent years, *D. lobulata* and *D. navarrensis*, both described from Costa Rica by Dr. H. Christ. The first appears to be a valid species, and the second to be synonymous with the South American *D. gigantea* Karst. To these are here added two more: *D. karsteniana*, long ago mentioned from Costa Rica by Karsten, and *D. ghiesbreghtii*, now described from Chiapas. Descriptions of all four will appear in the second part of volume 16, North American Flora. There are indications of two other species also, as noted below. The several species now recognized may be separated by the following key:

KEY TO SPECIES.

Veins usually 5 or 6 pairs; fertile veins simple or sometimes once forked.

Fertile segments 4 to 4.5 mm. broad; fertile veins simple; sori about 1.5 mm. broad . . . . . 1. *D. lobulata*.

Fertile segments 3 to 3.5 mm. broad; fertile veins simple or the proximal ones frequently once forked; sori about 1 mm. broad . . . . . 2. *D. gigantea*.

Veins 7 or 8 pairs; fertile veins mostly once or twice forked.

Fertile segments 4 to 5 mm. broad; fertile veins once or commonly twice forked . . . . . 3. *D. karsteniana*.

Fertile segments 3 to 3.5 mm. broad, appearing much narrower than the preceding, the lobes also narrower; fertile veins usually once forked . . . . . 4. *D. ghiesbreghtii*.



1. *Dicksonia lobulata* Christ, Bull. Herb. Boiss. II. 6: 187. 1906.

TYPE LOCALITY: Cerros de Velirla, Copey, Costa Rica, altitude 2,600 to 2,700 meters.

DISTRIBUTION: Known only from Costa Rica.

Three sheets of the type number (*Tonduz* 11789) are in the U. S. National Herbarium, and the species is probably known only from this collection. The venation is that ascribed by Karsten to *Dicksonia gigantea*, but the plant differs materially from that species in its broader and more obtuse segments, as well as in its larger sori.

2. *Dicksonia gigantea* Karst. Fl. Columb. 2: 177. 1869.

*Dicksonia navarrensis* Christ, Bull. Herb. Boiss. II. 6: 188. 1906.

TYPE LOCALITY: Mount Guadalupe, Andes of Bogota, Colombia, altitude 2,600 meters.

DISTRIBUTION: High mountains of Colombia, Panama, and Costa Rica.

ILLUSTRATION: Karst. loc. cit. *pl.* 193; Ann. Rep. Smiths. Inst. 1911: *pl.* 13. *f.* B, *pl.* 14 (as *D. navarrensis*).

A comparison of authentic material of *Dicksonia navarrensis*, both of Wercklé's original collection and a more ample series collected near the type locality by the writer in 1906, with Karsten's description and illustration of *D. gigantea* leaves scarcely any doubt that they represent a single species. More recently gathered material from Chiriqui, Panama, strengthens this conclusion. Not all fertile segments have simple veins, however, as supposed by Karsten. This is particularly true of the larger, fully fertile segments of the lower and middle parts of the pinnule, in which the fertile veins of the proximal side of the segment are frequently once forked, while those of the distal side are almost invariably simple. The branches of the veins are delicate, however, and inconspicuous, their development being accompanied by only a slight crenation of the fertile lobes.

*Dicksonia gigantea* is much more closely related to *D. lobulata* than to *D. karsteniana*, as indicated in the key.

The following specimens are in the U. S. National Herbarium:

COSTA RICA: Without definite locality, *Wercklé* (4 sheets, *ex herb. Christ*). Without locality, *J. J. Cooper* (3 sheets). Mountains 5 miles south of Cartago, alt. 1,800 meters, *Maxon* 513; *Maxon* 528.

PANAMA: Humid forest between Alto de los Palmas and Cerro de la Horqueta, Chiriqui, alt. 2,100 to 2,268 meters, March 18, 1911, *Maxon* 5513.

3. *Dicksonia karsteniana* (Klotzsch) Karst. Fl. Columb. 2: 179. 1869.

*Balantium karstenianum* Klotzsch, Linnaea 20: 444. 1847.

TYPE LOCALITY: Colombia.

DISTRIBUTION: Wet forests of the high mountains of Venezuela, Colombia, and Costa Rica.

ILLUSTRATION: Karst. loc. cit. *pls.* 194, 195. *f.* 7-17.

Known to the writer chiefly from Costa Rica specimens collected in the vicinity of Coliblanco, upon the slopes of the Volcano Turrialba, altitude about 1,950 meters (*Maxon* 325), which agree fairly well with Karsten's illustration and with fragmentary South American and Costa Rican material in the Underwood Fern Herbarium at the New York Botanical Garden. Its relationship is apparently with *Dicksonia ghiesbreghtii*, from which it differs in the characters noted under that species.

4. *Dicksonia ghiesbreghtii* Maxon, sp. nov.

Caudex 4 to 5 meters high; fronds essentially tripinnate; primary rachis not seen; primary pinnæ linear-oblong, acuminate, not strongly asymmetrical, 60 to 70 cm. long, about 20 cm. broad, the secondary rachis 2 mm. thick, dull light brownish, slightly rough from the partial abrasion of the articulate turgid dirty yellow capillary scales; pinnules numerous, contiguous, alternate, sessile, inserted 2 to 2.5 cm. apart upon each side of the rachis, linear-oblong, long-acuminate, 8 to 12 cm. long, 2 to 2.5



cm. broad, the costa prominent, sparingly clothed below with spreading capillary scales like those of the secondary rachis, above scantily short-strigose; segments 20 or more pairs below the long-acuminate deeply serrate apex, linear-oblong, straight or apically subfalcate, short-acuminate, 10 to 15 mm. long, 3 to 3.5 mm. broad (or narrower by the curvature of the margins in drying), varying from sessile at the base of the pinnule to adnate and slightly decurrent in the outer part; sterile segments serrate to sharply and obliquely incised; fertile segments pinnatifid about two-thirds the distance to the costule, the lobes cucullate, usually broader than long, rounded, often slightly emarginate; costules elevated, those of the fertile segments bearing persistent capillary scales below; veins 7 or 8 pairs, those of the sterile segments mostly once or twice forked, those of the fertile segments sometimes simple, usually once forked, the sorus borne at the end of the distal branch, the other branch evident as a short spur immediately below; sori mostly 4 or 5 pairs, occupying the lower two-thirds of the segment, about 1 mm. broad; paraphyses numerous, rather long, flaccid, light brownish.

Type in the U. S. National Herbarium, no. 690479, collected in the temperate mountain region of Chiapas, Mexico, 1864-70, by Dr. A. Ghiesbreght (no. 353). This number was determined by Hall<sup>1</sup> as *Dicksoniana sellowiana* Hook., a South American species, from which it is widely different. More recently Doctor Christ has reported<sup>2</sup> (as *Cibotium wendlandi* Mett.) a plant from El Zontehuitz, Chiapas, altitude 2,858 meters, *Munch* 104, which may prove to be this species.

*Dicksonia ghiesbreghtii* is allied to *D. karsteniana*, from which it differs especially in its narrower segments and simpler venation, as well as in the narrower lobes of the segments and in having a rather noticeable covering of stiffish, turgid, short-celled hairs upon the costules.

#### DOUBTFUL MATERIAL.

There are at hand also the following specimens whose status can not be determined satisfactorily at present:

1. United States National Herbarium nos. 575152 and 830655, collected from "forêts de l'Achiote," Volcano Poas, Costa Rica, altitude 2,200 meters, November, 1896, by A. Tonduz (no. 10697). This number has been mentioned several times<sup>3</sup> by Doctor Christ as a species of *Cibotium*, being referred by him (apparently with some doubt) to *C. wendlandi*, although, as pointed out by the writer recently,<sup>4</sup> it really represents a species of *Dicksonia*. The aspect of these specimens is different from that of any North American species and rather strongly suggestive of larger states of *D. sellowiana* from Brazil. Further material from Poas will probably indicate the specific distinctness of this form.

2. United States National Herbarium no. 676144, collected near the summit of the Divide, above Camp I, Holcomb's trail, above El Boquete, Chiriqui, Panama, altitude about 1,900 meters, by William R. Maxon (no. 5668), March 23, 1911. This, which may be a form of *D. gigantea*, is notable for its narrower and more spreading pinnules, blunter and simpler segments, muriculate rachises, etc. Certain individuals in this locality, which were supposed to be of the same species, had trunks fully 6 meters high.

<sup>1</sup> Hall, Franklin W. Catalogue of a Collection of Ferns made in Southern Mexico, mainly at Chiapas, by Dr. A. Ghiesbreght, in the years 1864-70. pp. 10. New Haven, Connecticut. 1873.

<sup>2</sup> Bull. Herb. Boiss. II. 5: 251. 1905; 5: 734. 1905. (See Contr. U. S. Nat. Herb. 16: 57. 1912.)

<sup>3</sup> Bull. Herb. Boiss. II. 5: 734. 1905; 6: 189. 1906; 7: 273. 1907.

<sup>4</sup> Contr. U. S. Nat. Herb. 16: 57. 1912.



## THE GENUS ODONTOSORIA.

The genus *Odontosoria*, as recognized by Diels in the Pflanzenfamilien of Engler and Prantl,<sup>1</sup> comprises two sections or subgenera, the first (Eu-*Odontosoria*) containing rather small species of erect or ascending habit and determinate growth,<sup>2</sup> the second (*Stenoloma*) containing three species of indefinite scandent growth. These two groups are entitled to recognition as distinct genera. Adopting this view, it is necessary to apply the name *Odontosoria* to the second group, the large climbing species, rather than to the first. The grounds for this treatment are presented in the following brief account of the taxonomic history of the genus, with a review of the American species of true *Odontosoria*.

Presl<sup>3</sup> appears to have been the first to use the name *Odontosoria*, his application of it being to an assemblage of 17 species constituting his fourth section of the genus *Davallia*. Included among these are species of both types mentioned above. Naturally, the simpler, smaller plants of upright, determinate growth are listed first, and one of these (*Davallia tenuifolia* Swartz) is figured.<sup>4</sup> Since this is the only species of this subgenus illustrated by Presl it might reasonably have been taken by later authors to typify the subgenus.

Fée, however, who was the first to take up the name *Odontosoria* in a generic sense,<sup>5</sup> applied it to a single species, *O. uncinella* (Kunze) Fée (*Davallia uncinella* Kunze), which had not been published until 1850. Under past and current botanical rules the name *Odontosoria* must be applied according to Fée's use of it, and the type will therefore be *O. uncinella*. Most of the species of Presl's section *Odontosoria* were placed together by Fée under his new genus *Stenoloma*, and no distinctions were drawn as to the remarkably diverse habits of growth of the species thus included.

John Smith, writing of the ferns of Hongkong in 1857,<sup>6</sup> reported upon three species of *Odontosoria* (*O. tenuifolia*, *O. chinensis*, and *O. retusa*),<sup>7</sup> and added notes upon their generic characters. Later in the same year he elsewhere<sup>8</sup> characterized the genus more fully, mentioning the fronds as "1 to 5 feet long, erect or flexuose, scandent," and listed two species in cultivation, *O. tenuifolia* and *O.*

<sup>1</sup> Pflanzenfam. 14: 215. 1899.

<sup>2</sup> By error Diels includes here also *O. schlehtendahlia*, which is clearly of the second group.

<sup>3</sup> Tent. Pter. 129. 1836.

<sup>4</sup> Loc. cit. pl. 4. f. 27.

<sup>5</sup> Gen. Fil. 325. 1852.

<sup>6</sup> In Secm. Bot. Voy. Herald 429. 1857.

<sup>7</sup> The first two are forms of a single Old World species.

<sup>8</sup> Cat. Ferns 66. 1857.



*aculeata*. In 1866<sup>1</sup> he more exactly describes the fronds as "erect or flexuose and scandent," and lists three species, *O. tenuifolia*, *O. aculeata*, and *O. clavata*, the first and last being of the small erect type, the second of the climbing sort. In 1875<sup>2</sup> he adopts the same point of view, though definitely assigning *O. tenuifolia* as the type of the genus, and, after stating that about a dozen widely distributed tropical species constitute the genus, remarks that "they form two distinct groups, the first having definite fronds and the other scandent and indefinite, the latter forming the genus *Stenoloma* of Fée." (As a matter of fact, Fée's *Stenoloma* included plants of both sorts, as already stated.) Smith makes no mention of *O. uncinella*, the type of Fée's genus *Odontosoria*. In fact, he credits the genus *Odontosoria* to "Presl (1836)," ignoring the fact that the name was used by Presl only in a sectional or subgeneric sense. From this false standpoint he was correct in typifying the genus upon *O. tenuifolia*; but, as pointed out above, the genus must really date from Fée, with *O. uncinella* as its type.

The next writer to deal with this group was Kuhn,<sup>3</sup> who in 1882 properly distinguished the plants of indefinite scandent growth as a distinct generic group, but assigned to them the new name *Lindsayopsis*, listing three species: *Lindsayopsis divaricata* (Schlecht.), *L. aculeata* (L.), and *L. scandens* (Desv.). Since these species, however variable in indusium characters, are clearly congeneric with *O. uncinella*, the name *Lindsayopsis* becomes a synonym of *Odontosoria* Fée. The small species of upright growth are referred by Kuhn to no less than three genera, *Lindsaya* Dry., *Schizoloma* Gaud., and "Odontosoria Presl." Under *Odontosoria* he lists three species, one of them being *O. chinensis* (L.), which is the same as *Davallia tenuifolia* Swartz, the type of Presl's original subgenus *Odontosoria*.

Thus, not only John Smith but Kuhn and more recently Diels<sup>4</sup> have wrongly credited the genus to Presl and perhaps on this account have either directly or by implication typified it erroneously upon *Davallia tenuifolia*, instead of *O. uncinella*.

The systematic relationship of the many species listed by Kuhn under *Lindsaya* (43 species), *Schizoloma* (25 species), and *Odontosoria* (3 species) needs to be carefully investigated; but it is apparent that the plants called *Odontosoria chinensis* and *O. clavata* by Smith, Diels, Christensen, and most recent authors (the *Trichomanes chinensis* and *Adiantum clavatum*, respectively, of Linnæus) have no place under *Lindsaya*, *Schizoloma*, or, in its properly restricted sense, *Odontosoria*. For their accommodation the writer has proposed

<sup>1</sup> Ferns Brit. & For. 232, 317. 1866.

<sup>2</sup> Hist. Fil. 263. 1875.

<sup>3</sup> Gruppe Chaetop. 25-27. 1882.

<sup>4</sup> In Engl. & Prantl, Pflanzenfam. 14: 215. 1899.



recently<sup>1</sup> the new genus *Sphenomeris*, with the West Indian *O. clavata* as its type, *Sphenomeris clavata*. Besides the common Old World species *Sphenomeris chinensis*<sup>2</sup> and the Philippine *S. retusa*<sup>3</sup> there are several others to be removed hither from so-called *Lindsaya* and *Schizoloma*.

From the above it will appear (1) that Kuhn was the first, and up to the present has been the only one, to recognize the coherence of the climbing indeterminate "Davallias" as a distinct generic group; (2) that his error was mainly one of taxonomic practice in applying to this the new name *Lindsayopsis*, whereas it should have retained the name *Odontosoria*; (3) that the small group of species typified by *Odontosoria clavata* and *O. chinensis* of authors is to be recognized as a distinct genus, *Sphenomeris*, allied to *Odontosoria*, *Lindsaya*, and *Schizoloma*.

Even the commoner species of *Odontosoria* have been subject to much misidentification, which, considering their peculiar morphology, is not remarkable. Most of the confusion centers upon the varying application of the Linnæan name *aculeatum* in the past, as discussed at some length below. In lieu of complete descriptions of all the species the following key is made rather more full than would otherwise be necessary.

#### ODONTOSORIA (Presl) Fée.

*Odontosoria* (Presl) Fée, Gen. Fil. 325. 1852.

*Davallia* § *Odontosoria* Presl, Tent. Pter. 129. 1836, in part.

Relatively large plants of scandent habit, the fronds ascending, elongate, of indeterminate growth, the opposite primary pinnae borne in acropetal succession. Rhizomes slender (2 to 4 mm. in diameter), woody, creeping, densely paleaceous, more or less freely branched. Fronds elongate-deltoid to linear, up to 6 meters long, the primary rachis woody, subterete to trigonous, smooth or variously spiny; lamina bipinnate to quadripinnate, in most species finely dissected, the ultimate pinnules variously lobed, cleft, or parted, the straight or usually flexuous rachises spiny or, in a few species, unarmed; veins forked, free; sori terminal, 1 to 3 to each ultimate segment, more or less endophyllous, the indusium either wholly joined to the scarcely different opposed leaf lobe and forming an urceolate or obconical involucre open only at the leaf margin, or in some species partially free at the sides, the involucre then slightly bilobed; spores triplanate.

Type species, *Odontosoria uncinella* (Kunze) Fée.

#### KEY TO THE SPECIES.

Plants provided with stout to slender spines upon some or all of their rachises.

Ultimate (terminal) divisions relatively coarse, cuneiform, narrowly deltoid, obovate, or rhombic from a sharply cuneate to inequilateral rectangular base, variously cleft, lobed, or incised, the lobes not monosorous.

<sup>1</sup> Journ. Washington Acad. Sci. 3: 144. 1913.

<sup>2</sup> *Adiantum chinense* L. Sp. Pl. 1099. 1753.

<sup>3</sup> *Davallia retusa* Cav. Descr. Pl. 278. 1802.



- Fronds relatively small, tripinnate, the primary pinnæ comprising 1 to 4 pairs of distant linear once-pinnate lateral branches and a similar elongate terminal one..... 1. *O. uncinella*.
- Fronds very much larger, essentially quadripinnate, the secondary pinnæ ovate to deltoid, mostly imbricate, numerous, the apical ones gradually smaller.
- Rachises (the primary ones excepted) divaricately flexuous, conspicuously spiny nearly throughout.
- Pinnules of the fourth order irregularly rhombic, consisting of 2 to 4 cuneate-deltoid segments, these sharply cleft in the middle, each lobe emarginate and bisoriate; spines long, acicular, spreading..... 2. *O. aculeata*.
- Pinnules of the fourth order rhombic to irregularly obcordate, simple, or the larger ones with 1 or 2 large free obcordate lateral segments, the terminal segment subrhombic, irregularly 1 or 2-lobed; sori several to each lobe; spines short, stout, retrorse..... 3. *O. jenmani*.
- Rachises straight; spines minute and few, mostly confined to the tertiary rachises.. 4. *O. flexuosa*.
- Ultimate (terminal) lobes or divisions narrow, linear to oblong or slightly clavate (never rhombic, ovate, or deltoid), usually monosorous, or, if cleft at the apex, each portion soriferous.
- Rachises beset with long spreading acicular spines.. 5. *O. wrightiana*.
- Rachises beset with conical mainly retrorse spines.
- Fronds relatively small, skeleton-like, about 70 cm. broad; ultimate divisions almost capillary, 0.2 to 0.5 mm. broad..... 6. *O. colombiana*.
- Fronds much larger (1 to 1.4 meters broad), distinctly leafy in appearance; ultimate divisions much larger, 0.7 to 1.5 mm. broad; spines stouter.
- Segments of the fifth order mostly flabelately parted, sharply cuneate, the 2 to 4 slender scarcely clavate divisions small, acutely joined; spines of the secondary rachis scattered, the larger ones 3 to 4 mm. long..... 7. *O. fumaroides*.
- Segments of the fifth order once to three times forked (often appearing twice dichotomous), the 2 to 4 distinctly clavate divisions widely divaricate; spines of the secondary rachis numerous, short (not exceeding 1.5 mm.)..... 8. *O. gymnogrammoides*.



Plants wholly unarmed.

Ultimate (terminal) divisions almost capillary, divaricate, 0.3 to 0.5 mm. broad (not broader than the narrowly foliaceous-marginate costæ), linear, or slightly clavate at the monosorous apices . . . . . 9. *O. schlechtendahlia*.

Ultimate (terminal) lobes broader, shorter, foliaceous, 0.6 to 1.0 mm. broad, not distinct, cuneately joined in pairs, these again acutely joined, the segments thus in general 2 to 4 times flabellately parted or cleft, invariably cuneate . . . . . 10. *O. guatemalensis*.

1. *Odontosoria uncinella* (Kunze) Fée, Gen. Fil. 326. 1852.

*Davallia uncinella* Kunze, Bot. Zeit. 8: 213. 1850.

*Microlepia uncinella* Mett. Fil. Hort. Lips. 103. 1856.

*Lindsaya uncinella* Krug, Bot. Jahrb. Engler 24: 92. 1897.

TYPE LOCALITY: Province of Santiago [Oriente], Cuba, altitude 1,200 meters (*Linden*).

DISTRIBUTION: Cuba and Porto Rico, ascending to 1,200 meters.

ILLUSTRATIONS: Fée, loc. cit. pl. 27 B. f. 1; Kunze, Farrnkr. 2: pl. 140 (as *Davallia uncinella*).

Specimens of the type collection of this species have not been seen by the writer. The description and figures cited above serve to distinguish it very well, however, and there is ample material also from the type region of eastern Cuba. The leaf tissue is thick and rigidly herbaceous, and in other respects the plant shows its affinity to the Jamaican species here called *Odontosoria jenmanii*, which in error has gone latterly under the name *O. aculeata*.

The following specimens are in the U. S. National Herbarium:

CUBA: Without definite locality, *Wright* 899. Upper slopes and summit of Gran Piedra, alt. 900 to 1,200 meters, climbing on tree trunks and on banks, April 14, 1907, *Maxon* 4046. Damp thickets, Rio Guayabo, above the Falls, Oriente, alt. 450 to 550 meters, *Shafer* 3629. Bushes along trail, Rio Yamanigüey to Camp Toa, Oriente, alt. 400 meters, *Shafer* 4012. Camp La Gloria, south of Sierra Moa, Oriente, *Shafer* 8155.

PORTO RICO: Mount Viva Christo, between Adjuntas and Guayanilla, at border of forest, *Sintenis* 4600. Mount Morales, near Utuado, in primeval forest, *Britton & Marble* 1457.

2. *Odontosoria aculeata* (L.) J. Smith, Cult. Ferns 67. 1857.

*Adiantum aculeatum* L. Sp. Pl. 1096. 1753, in greater part.

*Davallia aculeata* J. E. Smith, Mém. Acad. Sci. Turin 5: 415. 1793, in part.

*Davallia dumosa* Swartz, Syn. Fil. 135, 353. 1806.

*Stenoloma dumosum* Fée, Gen. Fil. 330. 1852, as to name only.

*Stenoloma aculeatum* Fée, Gen. Fil. 330. 1852, excluding reference to Sloane's plate.

*Microlepia aculeata* Mett. Fil. Hort. Lips. 103. 1856, as to description, in part, and excluding reference to Hook. pl. 54. B.

*Lindsaya aculeata* Mett. Ann. Sci. Nat. IV. Bot. 15: 65. 1861.

*Lindsayopsis aculeata* Kuhn, Gruppe Chaetop. 27. 1882.

TYPE LOCALITY: "Spiny bottom," near Leogane, Haiti (*Plumier*).

DISTRIBUTION: Santo Domingo, eastern Cuba, and Porto Rico, extending to 1,190 meters altitude.

ILLUSTRATIONS: Plum. Trait. Foug. pl. 94; Spreng. Anleit. Gewächs. 3: pl. 5. f. 37 (as *Adiantum aculeatum*); Fée,<sup>1</sup> loc. cit. pl. 27 bis. A. f. 4? (as *Stenoloma aculeatum*).

<sup>1</sup> Fée's illustration (pl. 27 bis. A. f. 4), cited above, may not represent true *O. aculeata*. It is characteristic of that species in everything save spines, and these are perhaps not drawn correctly. Usually the spines are straight and acicular, but in congested specimens they are likely to be shorter and stouter, or even a little curved. Not infrequently straight spines become somewhat curved from the plant's being dried under pressure. The spines shown in this figure are similar to those of *O. jenmani*, but the leaf segments are very different from those of that species.



The Linnæan species name *aculeatum*, published under *Adiantum*, has been applied very generally to two distinct species of this alliance and might with almost equally good reason be applied to a third. It was published originally with reference to three plates, mentioned in the following order: (1) Plumier's plate 94, representing a plant from the island of Santo Domingo; (2) Petiver's plate 11, figure 6, which is a copy of the former; (3) Sloane's plate 61, representing a Jamaican plant which subsequently was described by Swartz under the name *fumarioides*, which it has since retained and ought to retain. From the historical standpoint, therefore, as well as from the order of citation, the name *aculeatum* should be associated with the Santo Domingo plant. In some way, probably because the several species have not been very carefully collected or studied closely, the name *aculeatum* has been applied not only to the Santo Domingo plant, but also to a related Jamaican species which is not that figured by Sloane in plate 61. This Jamaican plant is well described by Jenman, and is amply distinguished from the true *O. aculeata* of Santo Domingo, eastern Cuba, and Porto Rico, by its simpler and coarser pinnules and by the character of its spines, these being short, stout, and retrorse in the Jamaican plant, whereas they are long, acicular, and spreading in true *aculeata*. Jenman's characterization is so excellent that there is good reason for dedicating this excellent species to him.

As to the Jamaican plant of Sloane, we have not only Sloane's plate (*pl.* 61), but also Jenman's testimony<sup>1</sup> that Sloane's specimen in the British Museum is the species known properly as *O. fumarioides*.

There exists among individuals of *O. aculeata* a great deal of variation in the degree of dissection, differences which apparently are due to habitat and altitude and partly to geographic considerations. Other factors which to an unusual extent affect the form of the individual are the age of the plant, the degree of fertility, and the seasonal condition of the plant when collected. Judging from the series at hand this species reaches its best development in eastern Cuba at about 600 meters elevation. The stout congested form shown in Plumier's plant is found in very few plants.

The following specimens are in the U. S. National Herbarium:

SANTO DOMINGO: Without locality, *Wright, Parry & Brummel* 33. Near Constanza, alt. 1,190 meters, *von Türckheim* 2995.

CUBA: Lower open slopes of Gran Piedra, Oriente, alt. 500 meters, *Maxon* 4090a. Upper slopes and summit of Gran Piedra, alt. 900 to 1,200 meters, *Maxon* 4073; *Shafer* 9066. Santa Ana, near Jaguey, Oriente, on steep banks in the open, *Maxon* 4131. Cooper's Ranch, base of El Yunque, near Baracoa, *Underwood & Earle* 817. Slopes and summit of El Yunque, alt. 300 to 600 meters, *Pollard & Palmer* 170. Loma Menquara, Oriente, alt. 680 to 1,000 meters, *Shafer* 3833. Alluvial valley of Rio Yamanigüey, Oriente, *Shafer* 4197. Without locality, *Wright* 960.

PORTO RICO: Near Rio Piedras, alt. 60 meters, *Hioram* 108; *Mr. & Mrs. A. A. Heller* 126. Near Mayaguez, alt. 120 meters, *Britton & Marble* 505; *Heller* (without number). Near Utuado, *Underwood & Griggs* 25; *Britton & Marble* 1074. Beatriz de Caguas, *Goll* 402, 403, 433. Maricao, *Sintenis* 169. Cayey, *Sintenis* 2172 (in part). Without locality, *Fisher* 71.

CULTIVATED SPECIMENS: Ex. herb. Hort. Bot. Lips. (as *Microlepia aculeata*).

### 3. *Odontosoria jenmanii* Maxon, sp. nov.

PLATE 2.

"*Davallia aculeata*" Jenman, Bull. Bot. Dept. Jamaica I. 23: 6. 1891 (excluding reference to Plum. *pl.* 94 and Hook. *pl.* 54. B), not *Adiantum aculeatum* L. in any part.

Fronds distichous, ascending, scandent, 2 to 6 meters long, intricate; rhizome slender, terete, wide-creeping, freely branched, densely clothed with lance-attenuate imbricate bright brown scales; lamina greatly elongate, quadripinnate throughout;

<sup>1</sup> Journ. Bot. Brit. & For. 24: 41. 1886.





ODONTOSORIA JENMANII MAXON.



primary rachis stout (3 to 3.5 mm. in diameter), castaneous, subterete, only the upper side flattish (with a low marginal ridge at each side), the under parts beset with numerous short stout conical spines less than 1 mm. long; primary pinnæ opposite, deltoid, 30 to 50 cm. long, 20 to 35 cm. broad, comprising about 4 to 8 pairs of spreading subopposite secondary pinnæ below the acuminate apex, the secondary rachis similar to the primary, but sharply flexuous at the insertion of the secondary pinnæ, strongly aculeate below, the spines stout, conical, retrorse, 1 to 2 mm. long; secondary pinnæ similar to the primary, the basal pair distant, reduced, subaxillary, the larger ones (2 to 4 pairs) imbricate, deltoid, 10 to 18 cm. long, 7 to 14 cm. broad, spreading or reflexed, the tertiary rachises regularly flexuose, retrorsely aculeate below; pinnules of the third order 6 to 10 pairs below the gradually acuminate pinnate apex, the basal ones reduced, distant, subaxillary, the larger ones apart or contiguous, oblong-lanceolate from an unequal base, the quaternary rachises sinuous or subflexuous, smooth or obscurely aculeolate; pinnules of the fourth order numerous, sessile or minutely stalked, rhombic to irregularly obcordate, simple or the larger ones with 1 or 2 large free obcordate lateral segments, the terminal segment subrhombic, irregularly 1 or 2-lobed; sori several to each lobe, small, endophyllous, the involucre narrowly obconical, open only at the margin. Leaf tissue thick, spongiöse-herbaceous or subcoriaceous, the veins concealed or nearly so.

Type in the U. S. National Herbarium, nos. 427877-879, comprising three separate primary pinnæ taken from a plant growing on a bank in partial shade near Cinchona, Jamaica, altitude about 1,500 meters, April 25, 1903, by William R. Maxon (no. 1594).

The confusion of this species with the very different true *aculeata* from Cuba, Santo Domingo, and Porto Rico, has already been mentioned under the last preceding species, and the main points of difference have been enumerated. Jenman's description is inaccurate in one respect: The sori are not, as a rule, solitary upon the ultimate divisions, but occur usually in 2's or 3's at the ends of the 2 or 3 ultimate veinlets. Plumier's plate 94 cited by Jenman represents true *O. aculeata*. Hooker's plate 54, B, also cited by him, undoubtedly illustrates the Lesser Antilles plant here treated as *O. flexuosa*, the figure having been drawn probably from a Dominica specimen.

Jenman's comment upon this species is as follows: "Abundant in forests and their skirts, forming dense and impenetrable thickets from 2,500 ft. altitude up to the highest ridges and peaks. The fronds reach 15 or 20 ft. high, supported by each other or the surrounding bushes or trees, the lower pinnæ dying and decaying away as the top of the frond extends. Cutting through a thicket, it emits a very offensive smell; the juice produces a yellowish stain or dye."

Besides the type specimens the following are in the U. S. National Herbarium:

JAMAICA: Vicinity of Cinchona, alt. 1,500 meters, *Underwood* 465, 3123; *Clute* 102. Slopes above Tweedside, alt. 600 to 900 meters, *Maxon* 932a. Without definite locality, *Harris* 7428; *Hart* 348.

EXPLANATION OF PLATE 2.—Portion of the type specimen of *Odontosoria jenmanii*, showing the primary axis, the point of origin of the opposite primary pinnæ, and the first large pair of secondary pinnæ (the upper one almost completely). Natural size.

#### 4. *Odontosoria flexuosa* (Spreng.) Maxon.

*Davallia flexuosa* Spreng.; Kunze, Bot. Zeit. 8: 213. 1850.

*Microlepia flexuosa* Ettingsh. Farnkr. 208. 1865.

TYPE LOCALITY: Martinique (*Sieber* 23).

DISTRIBUTION: Known only from Martinique, Guadeloupe, and Dominica, ascending to 580 meters.

ILLUSTRATIONS: Hook. Sp. Fil. 1: pl. 54. B (as *Davallia aculeata*); Fée, Gen. Fil. pl. 27 B. f. 2 (as *Stenoloma dumosum*); Ettingsh. loc. cit. pl. 138. f. 4. pl. 140. f. 5. (as *Microlepia flexuosa*).

This, the only member of *Odontosoria* known from the Lesser Antilles, was first given a name by Sprengel, which, though early mentioned in print,<sup>1</sup> was not associated

<sup>1</sup> Presl, Tent. Pter. 129. 1836, name only.



with a diagnosis until 1850, when Kunze described the species briefly but accurately, basing his diagnosis wholly upon the Martinique plant (Sieber, Fl. Martin. Suppl. no. 23) cited by Presl, as represented in the Berlin herbarium. Kunze refers here also two specimens from Santo Domingo: (1) A plant communicated by Mertens as *Davallia dumosa*, and (2) a specimen mentioned and figured by Sprengel in 1804<sup>1</sup> as *Adiantum aculeatum*. The former specimen has not been seen by the writer, but presumably it is like the latter, which, as figured by Sprengel, is certainly a form of true *Odontosoria aculeata* having the spines somewhat curved.

In addition to the peculiar shape of the segments, *Odontosoria flexuosa* is well distinguished by the unusual character of its rachises. The primary rachis, which is of a rich purplish castaneous color, is flattish above, with a strong and rather sharp marginal ridge at either side. On the lower side it is more or less acutely angled, the rachis thus in cross section rather strongly trigonous, as shown in Fée's illustration cited above. Strangely enough the secondary and tertiary rachises are not at all flexuose, as in other species of the genus, and usually the primary rachis also is straight. In the lower (older) parts, however, the primary rachis is sometimes sinuously flexuose, though not in the sense of "zigzag," as the term flexuose is commonly employed. Sprengel's name *flexuosa*, therefore, is not only relatively inappropriate but actually so, and we can only conjecture that besides Sieber's Martinique plant there were other elements (specifically different and from other regions, with zigzag rachises) included by Sprengel under that name. The actual type of *flexuosa*, nevertheless, is clearly Sieber's no. 23, since Kunze expressly states that this served for his diagnosis.<sup>2</sup>

Hooker's treatment of this group is very largely incorrect. The species figured by him as *Davallia aculeata* is certainly *O. flexuosa*, the illustration presumably being drawn from a Dominica plant collected by Imray (no. 7), cited by Hooker.

The material of *O. flexuosa* in the U. S. National Herbarium, cited below, is very complete and admits of no doubt as to the specific distinctness of the Lesser Antilles plant.

MARTINIQUE: Route du Morne-Rouge à Calabasse, alt. 580 meters, *Duss* 1682.

GUADELOUPE: Without definite locality, *Duss* 4238 (4 sheets).

DOMINICA: Laudat, *Lloyd* 115 (2 sheets). Without definite locality, *Eggers*.

##### 5. *Odontosoria wrightiana* Maxon, sp. nov.

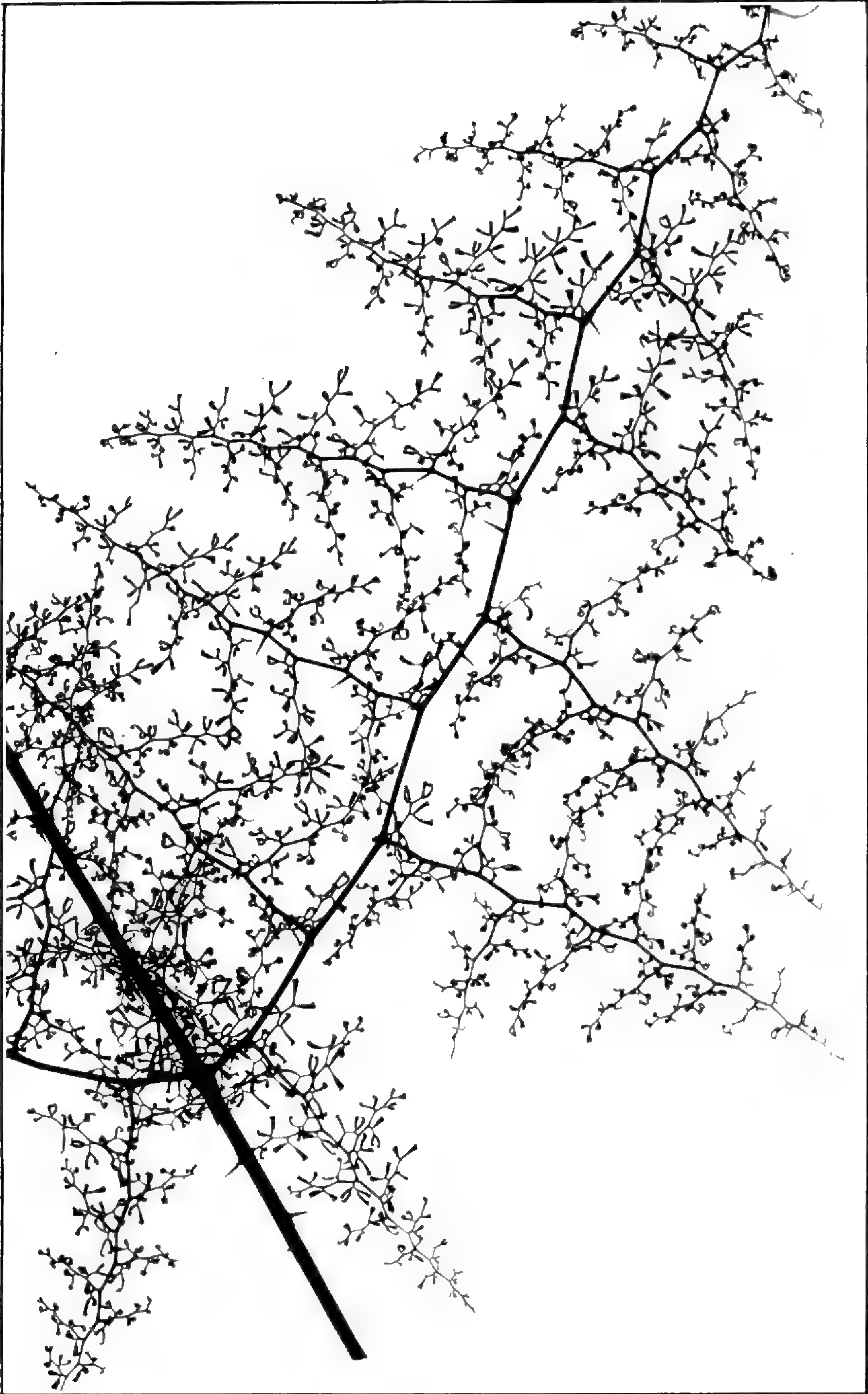
PLATE 3.

Plants of comparatively small size in all parts, the fronds ascending, scandent, 0.6 to 2 meters long. Rhizome slender (2 to 2.5 mm. in diameter), woody, creeping, branched, tortuous, densely invested with acicular golden brown scales; lamina quadripinnate, in young specimens deltoid, in mature ones greatly elongate, oblong to linear-oblong; primary rachis slender (1.5 to 2 mm. in diameter), dark reddish, subterete, only the upper surface flattish (with a slender marginal ridge at each side), the sides and under part beset with numerous acicular straight spreading spines 2 to 3.5 mm. long; primary pinnae of mature specimens opposite, 8 to 11 cm. apart, deltoid to ovate, 15 to 20 cm. long, 8 to 13 cm. broad, spreading, the secondary rachis strongly flexuose, reddish to stramineous, bearing numerous straight spreading acicular spines up to 4 mm. long; secondary pinnae subopposite to alternate, deltoid to deltoid-oblong, the larger ones (5 or 6 pairs) 3.5 to 7 cm. long, 2 to 6 cm. broad, adjacent or somewhat apart, spreading, the tertiary rachises very slender, strongly flexuose, bearing numerous very slender acicular spines up to 3.5 mm. long; pinnules of the third order similar in shape to the secondary pinnae, the basal ones sometimes not reduced, the larger ones (5 to 7 pairs below the acutish apex) adjacent or somewhat apart, alternate, their slender rachises unarmed or sparingly spiny; pinnules of the fourth order 2 to 4 pairs, alternate, the larger ones comprising 1 or 2 unequally stalked cuneate divisions, each

<sup>1</sup> Anleit. Gewächs. 3: 150. pl. 5. f. 37. 1804.

<sup>2</sup> A photograph and a fragment of this specimen, recently received through the kindness of Dr. I. Urban, accord perfectly with the other material studied and here cited.





ODONTOSORIA WRIGHTIANA MAXON.



of these cleft or divided nearly to the base into 2 slender ultimate segments, these thus nearly free or acutely joined in pairs, linear or slightly clavate, 1.5 to 4 mm. long, mostly 0.5 mm. or less broad; veins solitary in each division, or, if 2, each extending to a separate marginal lobe; sori solitary, each completely terminating a division or lobe, the indusium transversely oblong or oval, more delicate than the opposed leaf portion, whitish, partially free at each side. Leaf tissue rigidly herbaceous, the veins slightly elevated.

Type in the U. S. National Herbarium, no. 372179, collected in an open bushy ravine near Pinar del Rio, province of Pinar del Rio, Cuba, February 22, 1900, by William Palmer and J. H. Riley (no. 42).

This form has been referred sometimes to *O. fumarioides*, with which species it has no near relationship whatever. In its armature it is not unlike true *O. aculeata*, as here defined, and notwithstanding its remarkably fine-cut foliage it is in other respects clearly allied to that species. It is one of the smallest members of the genus.

The following material is in the U. S. National Herbarium:

CUBA: Without locality, *Wright* 898, 1804. *Herradura*, *Van Hermann* 760; *Baker* 2074; *Britton & Earle* 6589. Near El Guama, in small ravine of exposed mountain slope, *Palmer & Riley* 214. Consolacion del Sur, *Palmer & Riley* 469. Sierra de Cobra, on Guane Road, bank of stream, *Britton, Britton & Gager* 7187. (All but the first in the province Pinar del Rio.)

ISLE OF PINES: Near Nueva Gerona, flat ground among bushes, July 3, 1900, *Palmer & Riley* 984. Same locality, on exposed stream bank, July 7, 1900, *Palmer & Riley* 1022. Same locality, *Curtiss* 362. Without locality, *A. A. Taylor* 5.

EXPLANATION OF PLATE 3.—Portion of the type specimen of *Odontosoria wrightiana*, showing the primary axis and one of a pair of opposite primary pinnae. Natural size.

#### 6. *Odontosoria colombiana* Maxon, sp. nov.

Lamina not very ample, about 60 to 70 cm. broad, quadripinnate, the primary rachis castaneous, 2 to 2.5 mm. in diameter, subterete (only the upper face flattish, with a relatively heavy marginal ridge at each side), slightly muricate from the presence of a few minute scattering conical spines upon all sides, these about 0.5 mm. long; primary pinnae opposite, 30 to 40 cm. long, 10 to 20 cm. broad, oblong to narrowly ovate, the secondary rachis strongly flexuous, bearing a few narrowly conical hooked retrorse spines, 1 mm. long, or less; secondary pinnae (larger ones) about 10 or 12 pairs, alternate, strongly retrorse, approximate or distant, ovate to deltoid-oblong, 5 to 10 cm. long, 2.5 to 5 cm. broad, the tertiary rachises strongly flexuous, sparingly aculeolate below; pinnules of the third order ovate to deltoid-oblong, the larger ones (6 to 9 pairs) 1 to 2.5 cm. long, 0.5 to 1.3 cm. broad, alternate, retrorse-spreading, their rachises greenish-marginate, slender (0.3 to 0.4 mm. broad), flexuous; pinnules of the fourth order alternate, 3 to 7 pairs, variable in outline, the larger (basal and middle) ones consisting of 2 or 3 alternate stalked divisions, these usually once dichotomous, the segments divaricate, linear, 1.5 to 3 mm. long, 0.2 to 0.5 mm. broad, not broader than the slender similarly foliaceous stalks except at the slightly clavate apices; sori solitary, each terminating a segment, the indusium broadly triangular, nearly as broad as the scarcely modified opposed terminal portion of the segment, partially free at each side. Leaf tissue dark green, delicately herbaceous.

Type in the U. S. National Herbarium, no. 826368, collected near Amalfi, province of Antioquia, Colombia, altitude about 2,000 meters, September, 1884, by F. C. Lehmann (no. XXXIV).

In the shape and size of the ultimate segments the resemblance of this species to *O. schlehtendahlui* is so great that a specimen of the above collection (Lehmann XXXIV) was so determined by Hieronymus.<sup>1</sup> But *O. schlehtendahlui* is entirely unarmed in

<sup>1</sup> Bot. Jahrb. Engler 34: 454. 1905.



all its parts, the rachises are less decidedly flexuose, and the secondary pinnæ and the pinnules are not sharply retrorse as in *O. colombiana*. The New Grenada plants cited by Mettenius<sup>1</sup> as *Lindsaya fumarioides* may possibly be of this species.

7. *Odontosoria fumarioides* (Swartz) J. Smith, Hist. Fil. 264. 1875. PLATE 4.  
*Adiantum aculeatum* L. Sp. Pl. 1096. 1753, in part, as to Jamaican plant figured by Sloane.

*Acrostichum aculeatum* L. Syst. Nat. ed. 10. 2: 1320. 1759.

*Davallia fumarioides* Swartz, Journ. Bot. Schrad. 1800<sup>2</sup>: 89. 1801.

*Trichomanes fumarioides* Poir. in Lam. Encycl. 8: 82. 1808.

*Stenoloma fumarioides* Fée, Gen. Fil. 330. 1852.

? *Lindsaya fumarioides* Mett. Ann. Sci. Nat. V. Bot. 2: 217. 1864.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Restricted to Jamaica, ascending from the lowlands to 750 meters or rarely to 1,000 meters elevation.

ILLUSTRATIONS: Sloane, Voy. Jam. 1: pl. 61; Hedw. Fil. Gen. Sp. [pl. 20,] (as *Davallia aculeata*).

As explained under *Odontosoria aculeata*, plate 61 of Sloane, representing a Jamaican plant, formed the lesser part of the Linnæan *Adiantum aculeatum*; and a Jamaican specimen of this same species, received from Swartz, was figured as *Davallia aculeata* by Hedwig in 1799. Two years later, however, Swartz distinguished the Jamaican plant as a new species, *Davallia fumarioides*. That he had not fully solved the problem is evident from his treatment in the Synopsis Filicum (1806), for he there recognizes three species: (1) *D. aculeata* of Jamaica and Santo Domingo, with citation of Sloane's plate 61; (2) *D. dumosa*, a new species from Santo Domingo, with citation of Plumier's plate 94; and (3) *D. fumarioides*, from Jamaica, with citation of Hedwig's plate [20]. The new species, *dumosa*, is thus a synonym of true *aculeata*, if *aculeata* be typified upon Sloane's plate 94, as seems proper. Sloane's plate 61 is certainly misunderstood by Swartz, however, for it represents exactly the species illustrated by Hedwig and named by Swartz *D. fumarioides*. What Jamaican plant Swartz may have had in hand as *D. aculeata* in 1806 is uncertain; but it may have been that here described as *Odontosoria jenmanii*, a species not represented by any of the figures cited and until the present time never given a valid name. With ample material there can be no possible confusion of these species; the only difficulty is found in explaining briefly the historical errors due to scanty material, misidentification of the plates, and a consequent misapplication of the species names.

*Odontosoria fumarioides* is a very common species in Jamaica. Jenman's comment<sup>2</sup> is as follows:

"Abundant among the lower hills on the skirts of woodland, among bushes, in hill-side pastures, and by open pathways, but not forming such dense thickets as the preceding [*O. jenmanii*], of which it is the lowland analogue, ascending only to about 2,500 ft. altitude, where that first appears. The two species hardly touch in their range."

The remarkably thin texture and narrow, deeply cut segments readily distinguish this from *O. jenmanii*, the only other Jamaican species. It is more closely allied to the Costa Rican *O. gymnogrammoides*.

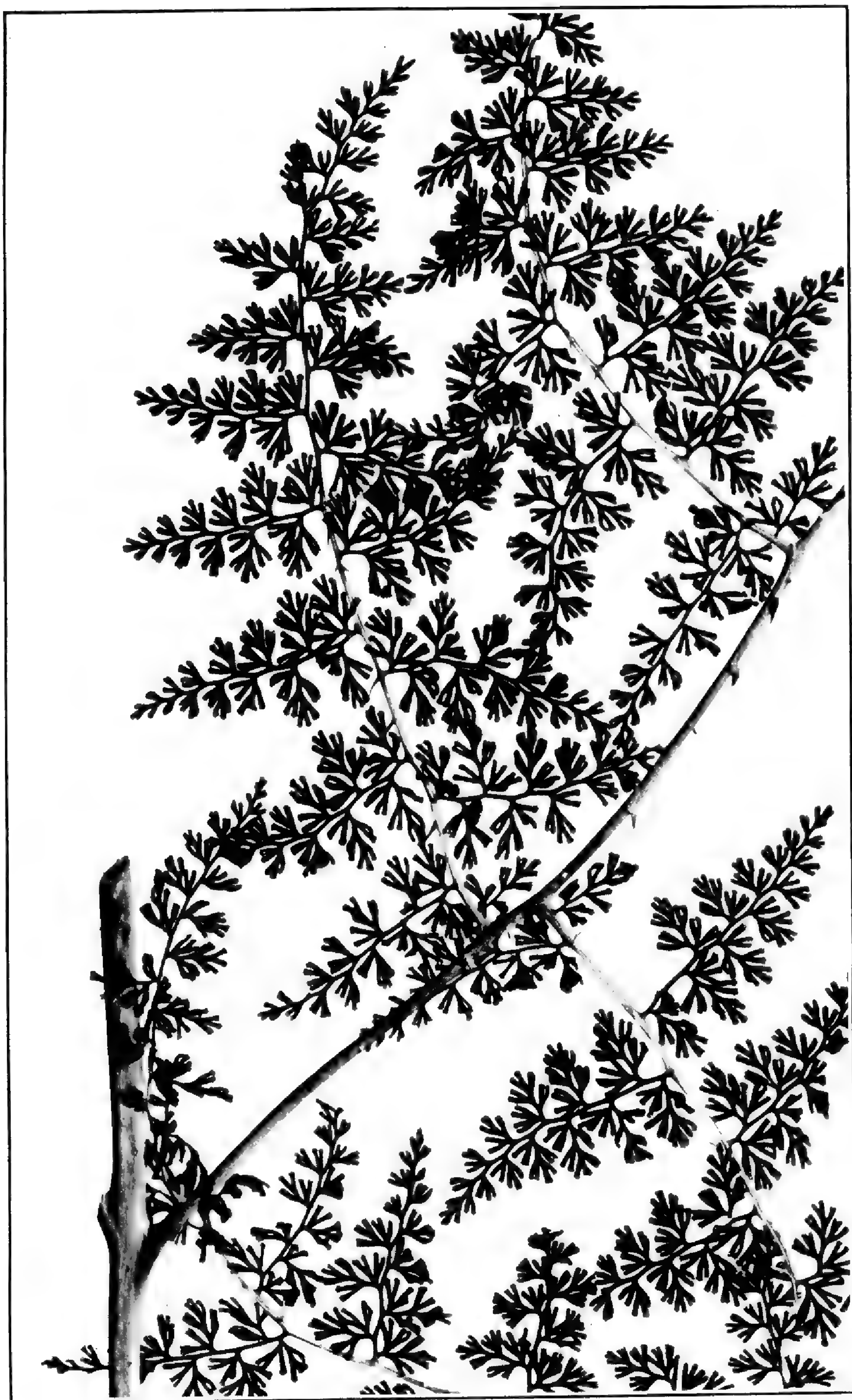
The following specimens are in the U. S. National Herbarium:

JAMAICA: Slopes above Ginger River (above Castleton), alt. 250 meters, climbing over bushes, Maxon 848. Trail from Bath to Cuna Cuna Pass, alt. 300 to 600 meters, Maxon, 1709, 1727. Vicinity of Hollymount, Mount Diabolo, alt. 750 meters, on open deforested bushy slopes, Maxon 2292. Mansfield, near

<sup>1</sup> Ann. Sci. Nat. V. Bot. 2: 217. 1864.

<sup>2</sup> Bull. Bot. Dept. Jamaica I. 23: 6, 7. 1891.





ODONTOSORIA FUMARIOIDES (SWARTZ) J. SMITH.





ODONTOSORIA GYMNOGRAMMOIDES CHRIST.



Bath, alt. 300 to 500 meters, *Maxon*. Above Gordontown, on dryish banks, *Maxon* 2804. Crown lands 4 miles west of Troy, alt. 750 meters, *Maxon* 2873. Near Troy, alt. 450 to 660 meters, *Underwood* 2925. Bull Head Mountain, *Underwood* 3357. Old England, alt. 1,000 meters, *Harris*. Cedar Valley, alt. 600 meters, *Clute* 156. Near Port Antonio, *Fredholm* 3231 (distributed as *Davallia aculeata*). Without locality, *Hart* 326.

EXPLANATION OF PLATE 4.—A characteristic section of *Odontosoria fumarioides*, showing the primary axis and the basal portion of one of the primary pinnæ; specimen from Hollymount, Mount Diabolo, Jamaica, alt. 750 meters, *Maxon* 2292. Natural size.

8. *Odontosoria gymnogrammoides* Christ, Bull. Soc. Bot. Genève II. 1: 228. 1909. PLATE 5.

TYPE LOCALITY: Estrella, province of Cartago, Costa Rica (*Cooper*).

DISTRIBUTION: Confined to the interior mountain region of Costa Rica, at 1,400 to 1,800 meters elevation.

The type collection of this species has not been seen by the writer. Agreeing with the description, however, are Costa Rican specimens, collected by the writer and cited by Doctor Christ. The species has some resemblance to *O. fumarioides* of Jamaica in cut of leaf and particularly in texture.

The following specimens are in the U. S. National Herbarium:

COSTA RICA: Estrella, province of Cartago, alt. 1,320 meters, *Cooper* (*J. D. Smith* 6015), the type collection. Without definite locality, *Cooper*; *A. de Zeledon*. Forests of Juan Viñas, *Pittier* (?) 10142. Volcano Turrialba, *Ridgway*. Near Pacayas, lower slopes of Volcano Turrialba, *Maxon* 350. Vicinity of La Palma, alt. 1,450 to 1,550 meters, *Maxon* 461. San Jeronimo, alt. 1,500 meters, *Wercklé*. Banks of the Rio Las Vueltas, Tucurrique, alt. 635 meters, *Tonduz* 12796. Santiago, near San Ramon, alt. 1,200 to 1,300 meters, *Brenes* 14207.

EXPLANATION OF PLATE 5.—A characteristic section of *Odontosoria gymnogrammoides*, showing the primary axis and the basal portion of one of the primary pinnæ; specimen from vicinity of Pacayas, Costa Rica, *Maxon* 350. Natural size.

9. *Odontosoria schlechtendahlia* (Presl) C. Chr. Ind. Fil. 209. 1905.

*Davallia divaricata* Schlecht. & Cham. Linnaea 5: 617. 1830, not Blume, 1828.

*Davallia schlechtendahlia* Presl, Tent. Pter. 129. 1836.

*Stenoloma schlechtendahlia* Fée, Gen. Fil. 330. 1852.

*Microlepia schlechtendahlia* Mett. Fil. Hort. Lips. 104. 1856.

*Odontoloma schlechtendahlia* Fourn. Mex. Pl. 132. 1872.

*Odontosoria divaricata* J. Smith, Hist. Fil. 264. 1875.

*Lindsayopsis divaricata* Kuhn, Gruppe Chaetop. 27. 1882.

*Lindsaya schlechtendahlia* Christ, Farnkr. Erde 296. 1897.

TYPE LOCALITY: Mexico.

DISTRIBUTION: Humid regions of eastern and southern Mexico, Guatemala, and British Honduras, ascending to 1,000 meters.

ILLUSTRATIONS: Fée, loc. cit. pl. 27 bis. A. f. 1; Hook. Sp. Fil. 1: pl. 54. C.

As noted above in the discussion of this genus as here restricted, the present species is wrongly placed by Diels with those species of small size and erect determinate growth, which properly constitute a separate genus, *Sphenomeris*. Nor is there warrant for using the name *divaricata* for this plant, since Schlechtendahl's publication of it is antedated two years by that of Blume.

*Odontosoria schlechtendahlia* finds its nearest ally in *O. guatemalensis* and is like that species in being wholly unarmed throughout.

The following specimens are in the U. S. National Herbarium:

MEXICO: District of Cordoba, Vera Cruz, *Fink* 105. Barrio Nuevo, Orizaba, *Rovirosa* 78. La Soledad, alt. 1,000 meters, *Langlassé* 976. Puebla, *Arsène*.

GUATEMALA: Choctum, *Salvin*.

BRITISH HONDURAS: Without locality, *Blancenaux*.



10. *Odontosoria guatemalensis* Christ, Bull. Soc. Bot. Genève II. 1: 229. 1909.

TYPE LOCALITY: Cuesta Grande, Hacienda de las Nubes, Guatemala (*Bernoulli & Cario* 402).

DISTRIBUTION: Apparently confined to western Guatemala, ascending to 1,800 meters.

This species, of which a few words of description were published by Doctor Christ in 1909, is one of marked peculiarity. Superficially it resembles the Jamaican *O. fumarioides*, but it is devoid of spines throughout and the ultimate divisions are smaller, shorter, and less divaricate. The nearly terete, highly polished, unarmed, castaneous rachises also are characteristic.

The following specimens are in the U. S. National Herbarium:

GUATEMALA: Pireneos, above San Felipe, alt. 1,200 to 1,500 meters, *Mazon & Hay* 3567. Santa Maria (lower slopes of the Volcan de Agua), alt. 1,500 to 1,800 meters, *Kellerman* 5586.

#### DOUBTFUL SPECIES.

1. *PROSOPTIA BIPINNATA* Presl, Tent. Pter. 116. *pl.* 6. *f.* 19. 1836 (name only).

Beyond the poor figure and the statement of the West Indies as type locality, there is apparently no means of identifying this species, which technically must be regarded as unpublished. It is referred doubtfully to *uncinella* by Mettenius, and to the same species by Christensen without reservation. The original specimen may be in Presl's herbarium at Prague.

2. *ODONTOSORIA SCANDENS* (Desv.) C. Chr. Ind. Fil. 354. 1905.

*Humata scandens* Desv. Mém. Soc. Linn. Paris 6: 324. 1827.

*Davallia scandens* Moore, Ind. Fil. 299. 1861, not Swartz, 1801.

*Lindsayopsis scandens* Kuhn, Gruppe Chaetop. 27. 1882.

The original description is as follows:

Frondebis scandentibus, tripinnatis, subaculeatis; pinnis oppositis distantibus; pinnulis infimis 2-4-pinnatis extimis cuneato-rhomboides, lobatisque; pinnellis subdecurrentibus, basi cuneatis, apice oblique bilobis; soris in margine incrassato affixis. Crescit in fruticetis peruvianis. Rachis funiculosa glabra, subquadrangularis.

There is at hand no material of this species, which appears to be known only from Peru. It was apparently studied by Kuhn, since it is one of the three species listed by him under *Lindsayopsis*, in his paper upon this group. By Christensen it is regarded as possibly identical with *O. uncinella*, although the description points to a plant very different from that species.

3. *DAVALLIA MITIS* Kunze, Bot. Zeit. 8: 214. 1850.

This, which is one of the species described by Kunze in his critical comments upon Hooker's treatment of the group in the first volume of the *Species Filicum*, is listed by Christensen (under *Davallia*) as an unidentified or doubtful member of *Odontosoria*. The type is a Guiana specimen collected by Poiteau and presented to Kunze by Bory.

#### NOTES UPON BOMMERIA AND RELATED GENERA.

##### BOMMERIA.

Among the many interesting ferns collected in eastern Mexico by Dr. C. A. Purpus within recent years is the following species, hitherto undescribed. Superficially it bears a certain resemblance to *Bommeria hispida* (*Gymnogramme hispida* Mett.) but differs somewhat in leaf form and very conspicuously in its areolate venation, *B. hispida* being free-veined throughout.





BOMMERIA SUBPALEACEA MAXON.



**Bommeria subpaleacea** Maxon, sp. nov.

PLATE 6.

Rhizome slender (about 2 mm. in diameter), creeping, closely covered with appressed rigid lance-acicular imbricate light brown scales (about 2 mm. long) with a blackish median stripe; fronds subfasciculate, apparently distichous, 8 to 13 cm. long; stipe 6 to 11 cm. long, straight or subflexuous, usually arcuate toward the base, stout (about 1 mm. thick), dark brown, at first densely and closely short-pilose, soon glabrescent and lustrous, toward the base bearing a few triangular-lanceolate to ovate, flattish, somewhat flaccid scales, these concolorous or with a narrow darker median stripe, minutely erose-denticulate; lamina 3 to 5.5 cm. long, 3 to 6 cm. broad, deltoid-cordate, subpentagonal, bipinnately parted at the base, the basal pinnules deltoid, inequilateral, strongly basispic, coarsely and obliquely pinnatifid, having the inferior basal lobe crenately lobed upon the proximal margin; middle (terminal) portion of the lamina equilateral, acute or acuminate, deeply, regularly, and obliquely pinnatifid, the segments (about 3 pairs) approximate, linear-oblong to oblong, simple and entire, or the larger ones crenate; leaf surfaces densely strigose, the midveins sparingly clothed below with brownish concolorous ovate flaccid scales, these flattish and subimbricate; venation almost wholly areolate, the costal areoles elongate, horizontal, 5 to 7 mm. long, the others very much smaller, oblique, extending in 2 or 3 irregular rows nearly to the margin, the ultimate (marginal) veinlets obscure, mostly free; sporangia borne upon all of the veins excepting most of the larger costal areoles, forming a conspicuous very broad marginal band.

Type in the U. S. National Herbarium, no. 841463, collected in some part of the Province of Puebla, Mexico, during August, 1909, by Dr. C. A. Purpus (no. 4025). No other specimens have been seen.

EXPLANATION OF PLATE 6.—Type specimens of *Bommeria subpaleacea*. Natural size.

The present description adds a fourth member to the small group of species recognized by Underwood<sup>1</sup> under the name of *Bommeria*, a genus first proposed by Fournier<sup>2</sup> in 1870. Of the species known previously, two, *Bommeria pedata* and *B. hispida*, are completely free-veined; while the third, *B. ehrenbergiana*, which is the type of the genus, has areolate venation similar to that of *B. subpaleacea*. In habit and particularly in their silky-strigose, pedate leaves and mostly slender, creeping rootstocks, all four species are much alike and they are unquestionably to be associated as a group, whatever its relative rank. They may be distinguished readily as follows:

## KEY TO THE SPECIES.

Venation almost wholly areolate.

Lamina 10 to 12 cm. long and broad, scantily short-strigose above, long-pilose below; sporangia confined to the outer areoles and free marginal veinlets, forming a comparatively narrow marginal band..... 1. *B. ehrenbergiana*.

Lamina 3 to 6 cm. long and broad, densely strigose upon both surfaces; sporangia borne upon all the veins, excepting only a part of the costal areoles..... 2. *B. subpaleacea*.

Venation wholly free.

Plants relatively small, the lamina usually about 5 or 6 cm. (casually 9 cm.) broad and long, the pinnæ and segments obtuse, rounded; leaf surfaces densely strigose above, below tomentose with stiff hairs intermixed... 3. *B. hispida*.

Plants much larger, the lamina usually 10 to 15 cm. broad and long, the pinnæ and large segments sharply acute or long-acuminate; leaf surfaces scantily strigose above, below densely pilose, the hairs unequal and spreading..... 4. *B. pedata*.

<sup>1</sup> Bull. Torrey Club 29: 633. 1902.

<sup>2</sup> Fourn. in Baill. Dict. Bot. 1: 448. 1876.



Of these the three species earlier described have been so generally misunderstood or confused with each other that further notes may be of value.

1. *Bommeria ehrenbergiana* (Klotzsch) Underw. Bull. Torrey Club **29**: 633. 1902.

*Gymnogramme ehrenbergiana* Klotzsch, Linnaea **20**: 411. 1847.

*Gymnogramme podophylla* Hook. Sp. Fil. **5**: 152. 1864.

*Stegnogramme ehrenbergiana* Fourn. Mex. Pl. **1**: 71. 1872.

*Hemionitis podophylla* J. Smith, Hist. Fil. 150. 1875.

*Dictyogramme podophylla* Trev. Atti Ist. Veneto V. **3**: 591. 1877.

*Bommeria podophylla* Fourn. Bull. Soc. Bot. France **27**: 328. 1880.

TYPE LOCALITY: "Ad thermas prope Grande, in regno mexicano" (*Ehrenberg* 662).

DISTRIBUTION: Probably confined to Mexico, though reported also from Guatemala.

ILLUSTRATION: Hook. loc. cit. pl. 296 (as *Gymnogramme podophylla*).

This species appears to be rare in collections. Klotzsch had but a single collection; Hooker had only Müller's plant (no. 719), beside Wright's Boundary Survey specimens (which are *B. hispida*); Underwood cites only a single collection; and there is in the National Herbarium but one specimen, this collected upon Orizaba in July, 1891, by Henry E. Seaton (no. 492), distributed as *Gymnogramme podophylla*.

2. *Bommeria subpaleacea* Maxon, Contr. U. S. Nat. Herb. **17**: 169. 1913.

TYPE LOCALITY: Province of Pueblo, Mexico.

DISTRIBUTION: Known only from the type collection (*Purpus* 4025).

ILLUSTRATION: Contr. U. S. Nat. Herb. **17**: pl. 6.

3. *Bommeria hispida* (Mett.) Underw. Bull. Torrey Club **29**: 633. 1902.

*Gymnogramme hispida* Mett.; Kuhn, Linnaea **36**: 72. 1869.

*Bommeria schaffneri* Fourn. Bull. Soc. Bot. France **27**: 327. 1880.

*Gymnogramme schaffneri* Baker, Ann. Bot. **5**: 484. 1891, not Moore, 1861.

*Neurogramme hispida* Diels in Engl. & Prantl, Pflanzenfam. **14**: 264. 1899.

*Gymnopteris hispida* Underw. Native Ferns ed. 6. 84. 1900.

TYPE LOCALITY: "Pass of the Limpia, [Texas,] crevices of rocks on the mountains" (*Wright* 819).

DISTRIBUTION: Western Texas to southern California; also common in Mexico.

This species shows wide variation in leaf shape and size. The most peculiar state is that represented by Pringle's 4420, which is the type of his variety *muralis*, a form which owes its reduced stature possibly to an unfavorable habitat upon the face of cliffs; some of the fronds, though less than 1 cm. wide, are yet perfectly fertile.

Besides the type collection of *Bommeria hispida* the following specimens are in the U. S. National Herbarium:

TEXAS: Limpio Mountains, July, 1883, *V. Havard*.

NEW MEXICO: Bear Mountains, November, 1886, *Rusby*. Organ Mountains, Dona Ana County, alt. 1,650 meters, *Wootton* 105; also other specimens. Guadalupe Canyon, at Mexican boundary line, *Mearns* 695.

ARIZONA: Lowell, May, 1884, *W. F. Parish*. Nogales, *William Palmer* 1204; *Evermann*. Bowie, *Jones* 4254. Baboquivari Mountains, April 6, 1884, *Pringle*. Chiricahua Mountains, *Rothrock* 513; *Blumer* 1962. Huachuca Mountains, August-October, 1882, *Lemmon*. Rincon Mountains, north slope, *Blumer* 3294. Santa Catalina Mountains, March, 1881, *G. R. Vasey*. Santa Rita Mountains, *Griffiths* 6055.

CALIFORNIA: Without locality, *E. Palmer*.

MEXICO: Fronteras, Sonora, alt. 1,400 meters, *Hartman* 29. Huchuerachi, Sonora, *Lloyd* 482. San Luis Potosí, alt. 1,800 to 2,100 meters, *Parry & Palmer* 1006. Valley of Mexico, *Schaffner* 32. Cliffs near Tequila, Jalisco, *Pringle* 4420. Rocky hills, Sandia Station, alt. 2,100 meters, *Pringle* 10151. Durango and vicinity, 1896, *E. Palmer* 556. Otinapa, Durango, 1906, *E. Palmer* 358.



**4. *Bommeria pedata* (Swartz) Fourn. Bull. Soc. Bot. France 27: 327. 1880.***Hemionitis pedata* Swartz, Syn. Fil. 20, 209. 1806.*Gymnogramma pedatum* Kaulf. Enum. Fil. 69. 1824.*Neurogramme pedata* Link, Fil. Hort. Berol. 139. 1841.*Gymnopteris pedata* C. Chr. Ind. Fil. 341. 1905.

TYPE LOCALITY: Not stated, but presumably Mexico.

DISTRIBUTION: Mexico and Guatemala.

ILLUSTRATION: Swartz, loc. cit. *pl. 1. f. 3* (as *Hemionitis pedata*).

The confusion of *Bommeria pedata* with *B. ehrenbergiana* probably accounts for the reference of the latter species to Guatemala, where it is not now known to occur. Swartz's illustration represents an imperfect frond but is otherwise characteristic.

The following specimens are in the U. S. National Herbarium:

MEXICO: Sierra de San Felipe, Oaxaca, alt. 2,100 to 2,400 meters, *C. L. Smith* 2040. Comaltepec, *Liebmann*. Nogales, Mount Orizaba, alt. 1,260 meters, *Seaton* 41. Tonilá, Colima, Mexico, *Jones* 540. Rio Blanco, Jalisco, 1886, *E. Palmer* 151. Damp shady banks near Guadalajara, Jalisco, alt. 1,350 meters, *Pringle* 1861; *Pringle* 11781. El Parque, Morelos, *Orcutt* 4390. La Venta, Jalisco, *Lemmon*.

GUATEMALA: Patal, near Santa Rosa, Baja Verapaz, alt. 1,600 meters, *von Türckheim* II. 2327. Near Cerro Redonde, Dept. Guajiniquilapa, alt. 1,300 meters, *Lehmann* 1684. Jumaytepeque, Dept. Santa Rosa, alt. 1,800 meters, *Heyde & Lux* (*J. D. Smith* 4086).

Although the relationship of these four species among themselves is evident enough, the actual rank to be assigned to *Bommeria* as a group is not very readily determinable, since there is involved the consideration of many diverse elements coming from a wide geographic area and doubtless representing many separate lines of descent. These elements, which have been variously associated by different writers and concerning which there is at present no general agreement, include species currently referred to *Ceropteris*, *Neurogramma*, *Gymnogramme*, *Hemionitis*, *Gymnopteris* Bernh. (not Presl), and even *Coniogramme* and *Dictyogramme*. The task of arranging the many species of these and closely related genera is an extended one and can not be undertaken in the present paper. It may be worth while, however, to mention a few facts which must be regarded in any serious attempt to reduce the existing confusion.

**HEMIONITIS.**

The genus *Hemionitis* of Linnæus, typified by the tropical American *Hemionitis palmata*, embraces upward of half a dozen species having the fertile fronds long-stipitate, the blades simply roundish, cordate, or halbert-shaped to palmately 5-parted, the veins copiously anastomosing, and the naked sporangia following the course of the veins nearly throughout and thus forming a delicate regular network over the lower surface. Most of the species are soft-hairy, and their agreement in other general characters is so close as to suggest a common ancestry.

A new species, received recently among other unidentified specimens from Costa Rica, may be described, in honor of its discoverer, as follows:

***Hemionitis otonis* Maxon, sp. nov.**

Plants small, 4.5 to 8 cm. high. Rhizome short, minute, densely clothed with light brownish buff linear-attenuate subentire scales (2 to 3 mm. long), these concolorous or the larger ones marked conspicuously by a castaneous median stripe; fronds



arranged in two series, the smaller ones rosulate, horizontal, mostly sterile, 1.5 to 2.5 cm. long, the stipe from one-half to one-third as long as the small suborbicular-cordate densely pilose lamina; larger fronds two or three, 4.5 to 8 cm. long, stiffly erect or somewhat arcuate, the stipe 2.5 to 5.5 cm. long, pilose, slightly paleaceous at the base, the lamina 2 to 5 cm. broad and long, suborbicular or very obtusely rounded-triangular from a cordate or reniform base, the sinus usually very deep; leaf tissue membrano-papyraceous, repand, finely pilose upon both surfaces; midveins lacking, the veins coarsely areolate without free veinlets, the elongate areoles pentagonal or hexagonal; sporangia following the veins in a thin line throughout.

Type in the U. S. National Herbarium, no. 691252, collected along the road from Ojo de Agua to Brasil (Santa Ana), Costa Rica, July 8, 1911, by Oton Jimenez (no. 333).

From the American species of *Hemionitis* previously known *H. otonis* is readily distinguished by its lesser size and suborbicular leaf blades.

#### GYMNOPTERIS.

Related to *Hemionitis* is the genus *Gymnopteris* of Bernhardt<sup>1</sup> founded upon the Jamaican *Pteris rufa*, or *Acrostichum rufum* of Linnæus—*Gymnopteris rufa* (L.) Bernh. In soft vestiture and in type and extent of sori the several species are not unlike *Hemionitis*; they differ mainly in their simply pinnate to subbipinnate fronds and free venation. In both *Hemionitis* and *Gymnopteris* the fronds are subfasciculate from a decumbent or ascending rhizome. Underwood<sup>2</sup> lists two North American species besides the type, namely *Gymnopteris subcordata* and *G. ferruginea*, which certainly must be excluded from this group of species. Both of these are discussed hereafter.

#### GYMNOGRAMMA.

The genus *Gymnogramme* of Hooker and Baker's *Synopsis Filicum* was treated at some length by Underwood in a paper<sup>3</sup> already cited. As published by Desvaux in 1811,<sup>4</sup> the name was given to an assemblage of 13 species arranged in five groups, according to the subdivision of their fronds, as pinnate, bipinnatifid, bipinnate, tripinnatifid, or decomposite. These species are now apportioned among 6 or 7 genera, and properly so. In determining the nomenclatorial type of the genus *Gymnogramma* Underwood selected the first named species, *Gymnogramma rufa* (the *Pteris rufa* or *Acrostichum rufum* of Linnæus), in which he is justified by the provisions of the American Code, since adopted. Nor is there especial warrant for any other decision, although the name has been variously applied by other writers in recent years, Christensen even regarding *G. flexuosa*,

<sup>1</sup> Journ. Bot. Schrad. 1799: 297. 1799. The name was subsequently used by Presl, mainly for a group of species now usually referred to *Leptochilus* and only remotely related to the genus *Gymnopteris* of Bernhardt.

<sup>2</sup> Bull. Torrey Club 29: 627. 1902.

<sup>3</sup> American Ferns, IV. The genus *Gymnogramme* of the *Synopsis Filicum*. Bull. Torrey Club. 29: 617-634. 1902.

<sup>4</sup> Ges. Naturf. Freund. Berlin Mag. 5: 304. 1811.



the last named of the original 13 species, as the type of the genus. Fixing its type as *G. rufa*, *Gymnogramma* becomes an exact synonym of *Gymnopteris*, published some 12 years earlier, and therefore need not concern us further. The group of species illustrated by *G. flexuosa* must probably bear the name *Psilogramme* Kuhn. The rest of the original species of *Gymnogramma* are divided among *Gymnopteris*, *Trismeria*, *Anogramma*, *Ceterach*, *Psilogramme*, and the genera commonly known as *Coniogramme* and *Ceropteris*.

The genus *Gymnogramme* of Hooker and Baker included many additional elements, which need not here be recapitulated.

#### CEROPTERIS AND PITYROGRAMMA.

It has been customary in recent years to refer the *Acrostichum calomelanos* of Linnæus and a few species of unmistakably close alliance (all of them long known as species of *Gymnogramma*) to *Ceropteris*, a genus proposed long ago by Link and restored by Underwood in 1902. *Ceropteris* dates from 1841; and the fact that Link had published the genus *Pityrogramma* in 1833,<sup>1</sup> applying the name to precisely the same group of species, seems to have been wholly overlooked. There is no valid reason why *Pityrogramma* should not displace *Ceropteris*. Two species are listed by Link: *Pityrogramma chrysophylla* Link (*Acrostichum chrysophyllum* Swartz) and *P. calomela* [sic] Link (*Acrostichum calomelanos* L.). The first of these will stand as the type of genus. The other North American species distinguished by Underwood, omitting unnecessary synonymy, are:

***Pityrogramma triangularis* (Kaulf.) Maxon.**

*Gymnogramma triangulare* Kaulf. Enum. Fil. 73. 1824.

***Pityrogramma viscosa* (D. C. Eaton) Maxon.**

*Gymnogramme triangularis viscosa* D. C. Eaton, Ferns N. Amer. 2: 16. 1880.

*Ceropteris viscosa* Underw. Bull. Torrey Club 29: 631. 1902.

***Pityrogramma tartarea* (Cav.) Maxon.**

*Acrostichum tartareum* Cav. Descr. Pl. 242. 1801.

***Pityrogramma peruviana* (Desv.) Maxon.**

*Gymnogramma peruviana* Desv. Ges. Naturf. Freund. Berlin Mag. 5: 329. 1811.

***Pityrogramma triangulata* (Jenman) Maxon.**

*Gymnogramma triangulata* Jenman, Bull. Bot. Dept. Jamaica II. 4: 206. 1897.

***Pityrogramma sulphurea* (Swartz) Maxon.**

*Acrostichum sulphureum* Swartz, Prodr. Veg. Ind. Occ. 129. 1788.

To these must be added the following single species, which ranges from Costa Rica and Panama to Peru:

***Pityrogramma ferruginea* (Kunze) Maxon.**

*Gymnogramme ferruginea* Kunze, Linnaea 9: 34. 1835.

*Gymnogramme bommeri* Christ, Bull. Soc. Bot. Belg. 35: 237. 1896.

*Gymnopteris ferruginea* Underw. Bull. Torrey Club 29: 628. 1902.

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<sup>1</sup> Link, Handb. Gewächse. 3: 19. 1833.



Except for its very dense hairy covering, *P. ferruginea* agrees closely with the largest species of *Pityrogramma* in every respect and has no near relationship with *Gymnopteris*, in which genus it was placed by Underwood.

#### NEUROGRAMMA.

The genus *Neurogramma*, proposed by Link<sup>1</sup> in 1841, has as its type *Acrostichum rufum* L., and thus, like *Gymnogramme*, is exactly synonymous with *Gymnopteris* Bernh. (not Presl) and has no standing. As taken up by Diels,<sup>2</sup> however, it is greatly extended and contains, besides the type species and its near allies, several distinct elements, among them the generic group which, as shown above, must bear the name *Pityrogramma*.

The name *Gymnopteris* is not employed by Diels in the sense of Bernhardt and Underwood, but is instead applied erroneously to the group called *Leptochilus* by Christensen, which is also, roughly, its application by Presl.

#### CONIOGRAMME.

Reference has been made under *Gymnopteris* (p. 172) to a Mexican plant described as *Gymnogramme subcordata* Eaton & Davenp.,<sup>3</sup> which was transferred to *Gymnopteris* by Underwood. A critical examination of the type material of this species in the U. S. National Herbarium shows that it is, instead, a member of the genus currently known as *Coniogramme* and that it is nearly related to *Coniogramme japonica*, as Eaton had suggested. The venation is correctly described by Davenport as follows:

Veins uniting below into two series of long irregular areolæ, the lower series parallel with the costa, the secondary series obliquely ascending, forked once or twice above and free to the edge; sori confined to the free veinlets.

The venation is not, however, shown in the published illustration. Large fronds are subbipinnate, a feature which, in connection with the peculiar venation and stramineous stipes and rachises, makes the reference of this plant to *Coniogramme* a very natural one. It may be known as *Coniogramme subcordata* (Eaton & Davenp.) Maxon.

*Coniogramme* Fée,<sup>4</sup> founded upon the free-veined forms of this alliance, is regarded by Diels and Christensen as including *Dictyogramme* Fée,<sup>5</sup> which was founded upon the areolate Japanese species, already mentioned, first described as *Hemionitis japonica* Thunb. Habitally the two groups are alike and should probably be joined. It is possible, however, that Presl's name *Dyctiogramme*, published

<sup>1</sup> Link, Fil. Hort. Berol. 138. 1841.

<sup>2</sup> Diels in Engl. & Prantl, Pflanzenfam. 14: 262. 1899.

<sup>3</sup> Contr. U. S. Nat. Herb. 5: 138. pl. 16. 1897.

<sup>4</sup> Gen. Fil. 167. 1852.

<sup>5</sup> Gen. Fil. 170. 1852.



in the *Epimeliae Botanicae*,<sup>1</sup> may antedate the two proposed by Fée. The title-page date of 1849 for the *Epimeliae* is known to be incorrect, and recently 1851 has been taken as the true date of publication. It has not been shown satisfactorily, however, that the completed work appeared earlier than 1852.<sup>2</sup> Under these circumstances preference should be given to Fée.

#### SUMMARY.

The above notes are intended to show that *Neurogramma* and *Gymnogramma*, each typified by *Acrostichum rufum*, are properly synonyms of *Gymnopteris*, itself founded upon the same species; that *Pityrogramma* must replace *Ceropteris*, as applied to the rather small genus of ferns of which *Acrostichum calomelanos* L. and *A. chrysophyllum* Swartz are familiar examples; that two of the species included under *Gymnopteris* by Underwood are not properly referable to that genus, one being here transferred to *Pityrogramma*, the other to *Coniogramme*, which is a genus not hitherto recognized from America; and that *Gymnogramma*, as it has been understood by most authors in the past, comprises many distinct generic elements, as emphasized by Underwood. Whether *Bommeria* itself can be successfully maintained as distinct from *Hemionitis* is doubtful. Christensen, indeed, transfers it bodily to *Gymnopteris* and maintains *Gymnopteris* as distinct from *Hemionitis*. It would have been quite as logical to merge both *Bommeria* and *Gymnopteris* under *Hemionitis*. As a matter of fact, the satisfactory arrangement of the species of this entire group must await the careful analysis and comparison of very many and widely divergent forms, many of them from distant regions and referred to still other genera. The present notes may be of assistance in that connection.

#### NEW SPECIES OF LYCOPODIUM.

The following species of *Lycopodium* from Guatemala, Costa Rica, and Panama appear to be distinct from any hitherto recognized. There are at hand also several other collections which probably represent undescribed species but which, either on account of insufficiency of material for full diagnosis or the need of comparison with little known species of South America, must await later study. Lack of complete South American material prevented a full treatment of the tropical American species by Underwood and Lloyd in their paper<sup>3</sup> of 1906, although the North American members of the genus are, with a few exceptions, now tolerably well understood.

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<sup>1</sup> Page 263.

<sup>2</sup> Upon this question see Hooker, *Journ. Bot.* 4: 286. 1852; J. Müller in A. DC. *Prodr.* 15: 258. 1862; Barnhart, *Bull. Torrey Club* 32: 590 (footnote). 1905.; Underwood, *Bull. Torrey Club* 33: 39 (footnote). 1906.

<sup>3</sup> *Bull. Torrey Club* 33: 101-124. 1906.



***Lycopodium brachiatum* Maxon, sp. nov.**

PLATE 7.

Plants apparently terrestrial, ascending, 15 to 20 cm. long, 3 to 5 times dichotomous, the branches spreading, widely divaricate ( $60^{\circ}$  to  $90^{\circ}$ ), the tips (if fertile) almost continuously sporangiate for a distance of 2 to 6 cm. Stems very slender (about 0.5 mm. in diameter), wholly concealed by the appressed imbricate bases of the very numerous closely set leaves; leaves apparently in 8 ranks, not twisted at the base, all alike, slightly ascending, somewhat secund, membranous, 5 to 6 mm. long, linear-subulate from a linear-lanceolate base (this about 0.5 mm. broad), subcapillary at the tips, entire, the upper surface usually somewhat concave in drying, often deeply so near the base, the basal portion of the leaf sometimes plicate, the apical portion often irregularly tortuous; costa percurrent, relatively prominent, readily visible by transmitted light, distinctly elevated below, the base of the leaf strongly carinate; sporophylls like the sterile leaves, not reduced in size; sporangia reniform to obtusely cordate-reniform, about 0.8 mm. broad, the sinus very deep.

Type in the U. S. National Herbarium, no. 22259, collected upon Cocos Island, off the western coast of Costa Rica, February 28, 1891, by Dr. Alexander Agassiz, during the cruise of the U. S. Bureau of Fisheries steamer *Albatross*.

An aberrant member of the group of *L. verticillatum* L. and nearest related to *L. portoricense* Underw. & Lloyd,<sup>1</sup> which is known only from Porto Rico. Like that species *L. brachiatum* appears to be terrestrial, which is unusual for members of the *verticillatum* group. It differs from *L. portoricense* mainly in its strongly divaricate branches (those of *L. portoricense* diverging at an angle of  $30^{\circ}$  to  $45^{\circ}$ ) and in its fewer, shorter, more spreading, 8-ranked leaves, those of *L. portoricense* being 6 to 8 mm. long, ascending, and arranged in 10 ranks.

EXPLANATION OF PLATE 7.—One of the type specimens of *Lycopodium brachiatum*. Natural size.

***Lycopodium chiricanum* Maxon, sp. nov.**

PLATE 8.

Plants terrestrial, caespitose, 8 to 12 cm. high, the main stems crowded, erect from an arcuate base, 1 to 3 times dichotomous, the branches erect and closely fasciculate. Stems stout, 6 to 8 mm. in diameter (including the leaves), densely leafy, the branches similarly stout and equally leafy throughout, the apices sporangiate a distance of 2 to 4 cm. or more, the sporangia wholly concealed by the sporophylls; leaves distinctly 10-ranked upon the lower stem, 11 or 12-ranked toward the apex, crowded, radially arranged, not twisted, ascending, densely imbricate, 3.5 to 5 mm. long, about 1 mm. broad, narrowly oblong, gradually acute in the apical third, not narrowed at the base, more or less cymbiform, the outer surface usually convex, the tip incurved, the inner surface flattish or slightly concave; leaf tissue chartaceo-coriaceous, more or less spongy, the leaf often wrinkled in drying; margins hyaline, minutely denticulate-serrulate (most noticeably so in the apical half), the teeth gland-like, variable in shape and position, sometimes low or even rounded; costæ percurrent but wholly concealed, their presence indicated by a dorsal ridge near the base or sometimes nearly throughout; sporophylls closely imbricate, similar to the sterile leaves but somewhat narrowed at the base, exactly lanceolate; sporangia reniform, 1.5 to 1.7 mm. broad, the sinus very broad and open.

Type in the U. S. National Herbarium, no. 675719, collected upon rocky open slopes of the summit of Chiriqui Volcano, Panama, altitude about 3,370 meters, March 12, 1911, by William R. Maxon (no. 5364).

*Lycopodium chiricanum* is not closely related to any North American species. Only a few South American members of the *selago* subgroup, to which this species belongs, have the leaves arranged in so many as 10 rows, and from these *L. chiricanum* seems altogether distinct. The foliage may be described as lutescent, or of a vivid yellowish green. There is no trace of red, as in many allied species.

EXPLANATION OF PLATE 8.—Type specimens of *Lycopodium chiricanum*. Natural size.

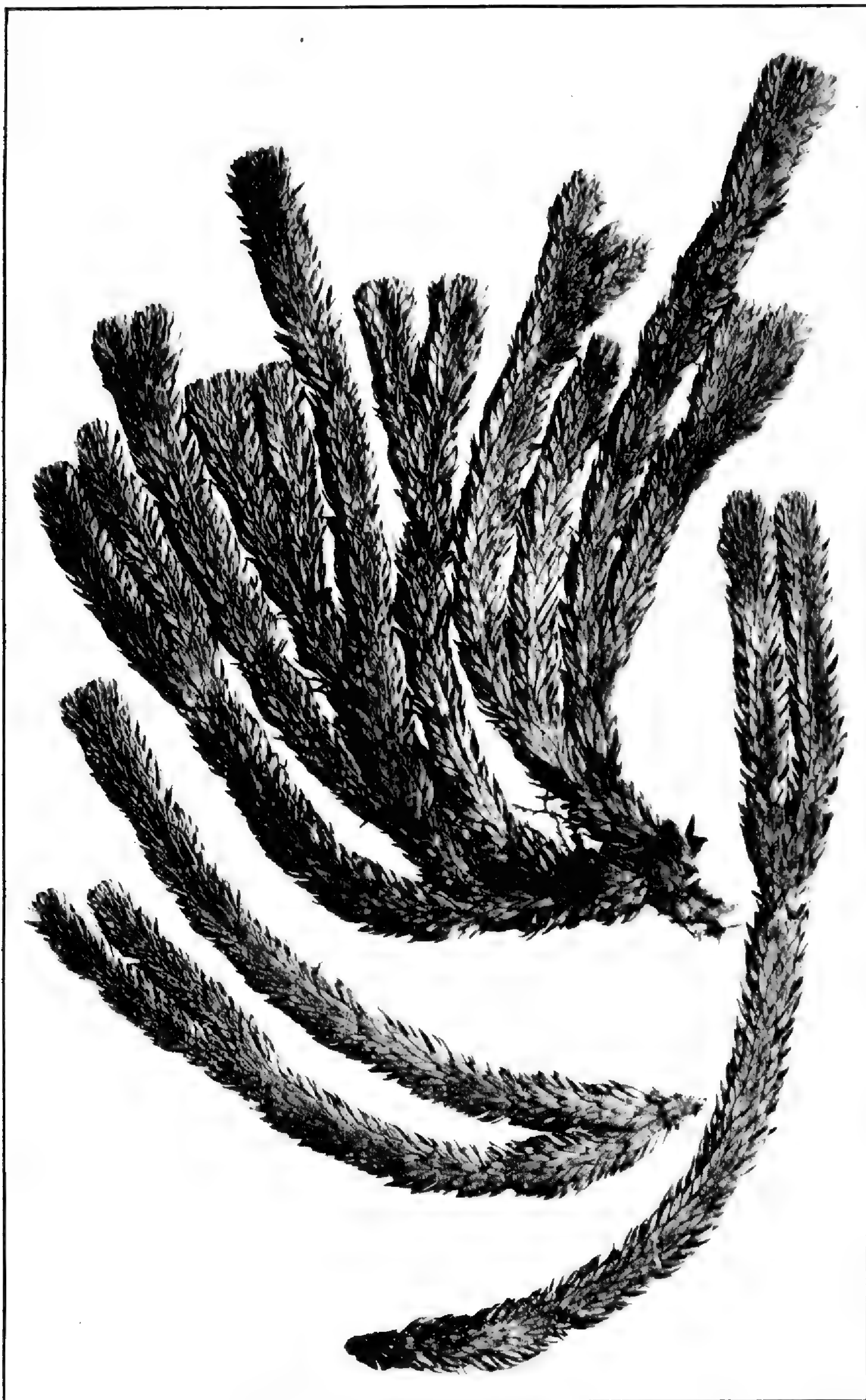
<sup>1</sup> Bull. Torrey Club 33: 108. 1906.





LYCOPodium BRACHIATUM MAXON.





LYCOPODIUM CHIRICANUM MAXON.





LYCOPodium GUATEMALENSIS MAXON AND L. UNDERWOODIANUM MAXON.



***Lycopodium guatemalense* Maxon, sp. nov.**

PLATE 9, a.

A delicate, diffuse, pendent epiphyte, 20 cm. long, 7 or 8 times dichotomous, interruptedly sporangiate in the apical half or two-thirds. Stem very slender (about 0.6 mm. in diameter), dull vermilion, the numerous branches of the same color, slender (0.3 to 0.5 mm. in diameter), slightly flexuous nearly throughout; leaves distant, borne in 6 or 8 ranks, spreading, strongly falcate, dull green, delicately membranaceous, very narrowly linear-lanceolate, 8 to 10 mm. long, 0.6 to 0.8 mm. broad, long-attenuate (the tips pungent, often reddish), entire, all somewhat twisted near the base, flat or the lower surface concave in drying, the leaf sometimes even subtubulose; costa medial, percurrent, visible upon the upper surface only near the tip (its course elsewhere marked often by a narrow furrow), evident beneath except toward the tip, the lower surface thus delicately carinate nearly throughout, the costa reddish at the base, strongly elevated, and together with the reddish leaf tissue long-decurrent upon the stem; sporophylls conform, arranged in zones 2 to 4 cm. long; sporangia suborbicular-reniform (the sinus rather shallow), averaging about 1 mm. broad, protruding beyond the twisted bases of the sporophylls a distance of 0.3 to 0.35 mm. on each side.

Type in the U. S. National Herbarium, no. 827041, collected upon tree trunks at Pansamalá, Alta Verapaz, Guatemala, altitude about 1,200 meters, July, 1886, by H. von Türckheim and distributed by Capt. John Donnell Smith as no. 957, *Lycopodium linifolium* var. *sanguineum* Spring.

Allied to *Lycopodium linifolium* L. and the Costa Rican *L. underwoodianum* Maxon<sup>1</sup> (Pl. 9, b); differing conspicuously from the former in its red stems, lesser size and more slender, strongly falcate leaves. From the latter it is readily distinguished by its reddish stems throughout, its lesser size and its much darker and broader leaves. Although a lax plant, it is much less so than *L. underwoodianum*, which is the most delicate species of the entire genus.

EXPLANATION OF PLATE 9.—Portions of type specimen of (a) *Lycopodium guatemalense*; (b) *L. underwoodianum* (Maxon 213). Both natural size.

***Lycopodium lancifolium* Maxon, sp. nov.**

Plants epiphytic, pendent, 20 to 30 cm. long, 5 to 8 times dichotomous, the branches laxly disposed, discontinuously sporangiate in the apical part. Stems slender (0.5 to 0.7 mm. in diameter), stramineous to light greenish, straight or nearly so, only partially concealed by the leaves; leaves yellowish green, herbaceous, ascending but not at all appressed, borne in 6 ranks, somewhat dorsiventrally arranged, those of the 4 lateral and upper rows more or less twisted at the base, those of the 2 under rows straight, the leaves otherwise all alike, narrowly lanceolate, attenuate, 7 to 10 mm. long, 1 to 1.5 mm. broad, slightly falcate in the outer part, entire, flat or the upper surface slightly convex; costa percurrent, nearly concealed above, visible in the outer part only by transmitted light, apparent below in the basal half of the leaf as a distinct ridge, the strongly carinate base decurrent, the stem thus appearing sharply angled; sporophylls similar to the sterile leaves but mostly smaller (5 to 7 mm. long), and slightly broadest at the base; sporangia orbicular-reniform, about 0.9 mm. broad.

Type in the U. S. National Herbarium, no. 676072, collected from the fallen branch of a large tree in dense humid forest along the upper Caldera River, near "Camp I," Holcomb's trail, above El Boquete, Chiriqui, Panama, altitude about 1,650 meters, March 23, 1911, by William R. Maxon (no. 5627). Other specimens (Maxon 5638) were gathered in the same vicinity at a slightly greater elevation.

*Lycopodium lancifolium* is allied to *L. linifolium*, but differs materially in its more slender, more sharply angled and less herbaceous stems, and especially in having the leaves very much shorter, relatively much broader (truly lanceolate instead of linear

<sup>1</sup> Contr. U. S. Nat. Herb. 13: 41. 1909.



to linear-lanceolate), less conspicuously costate, and of a much firmer texture. It is not likely to be mistaken for *L. linifolium* under any circumstances. Superficially only it somewhat resembles lax forms of *L. taxifolium*, though it is readily distinguished by its slender stems, and by its more distant, nonimbricate, and less rigid, 6-ranked leaves. The relationship with *L. taxifolium* is not close.

***Lycopodium tubulosum* Maxon, sp. nov.**

PLATE 10.

Plants epiphytic, pendent, 20 cm. long, 4 to 6 times dichotomous (the ultimate branches numerous and loosely fasciculate), continuously sporangiate in the apical third. Stems slender (0.6 to 0.8 mm. in diameter), partially obscured by the rather dense covering of leaves near the base, less so above, coarsely subflexuous; leaves dull yellowish green, rather rigidly membrano-herbaceous, strongly ascending, obscurely 6-ranked, mostly twisted near the base (the torsion often continued nearly throughout), the leaves thus somewhat dorsiventrally arranged, linear-lanceolate to subligulate, 10 to 13 mm. long, 1.2 to 1.4 mm. broad, narrowly acute, slightly narrowed at the base, falcate, entire, flattish or the inner surface more or less concave in drying; costæ percurrent, medial, evident as a slender dorsal ridge, stronger toward the base; sterile leaves of the upper branches gradually smaller, 5 to 7 mm. long, narrower, linear-acicular, concave or inwardly subtubulose, especially near their base; sporophylls 3 to 5 mm. long, strictly ascending, incurved, lance-acicular in outline, the bases about 1 mm. broad, carinate, strongly concave within and almost completely sheathing the sporangia, the sporophylls above this rather abruptly narrowed, tubulose except at the flattish acute tips; sporangia orbicular-reniform, about 1 mm. broad.

Type in the U. S. National Herbarium, no. 861142, collected at Pacayas, at the foot of the Volcano Turrialba, Costa Rica, altitude 1,400 meters, December, 1908, by P. Biolley, jr. (no. 17398).

*Lycopodium tubulosum* is related to *L. taxifolium* Swartz, but departs widely from that in all essential characters. It is very much more slender and is smaller in all its parts, with very numerous, loosely fasciculate, lax, fertile branches, very much smaller, narrower and differently shaped leaves, and sporangia half the size of those of *L. taxifolium*. It shows an alliance to that species chiefly in its tortuous leaves and tubulose sporophylls. The last feature, however, is not an invariable character of *L. taxifolium* and is to be observed only in certain very large and fully mature individuals which are uncommonly fertile and have the sporophylls much reduced and very different in shape from the sterile leaves. Other (mostly younger) specimens of *L. taxifolium* have the sporophylls of precisely the same size and shape as the sterile leaves. The sporophylls of *L. tubulosum* are strongly incurved (which is not true for any form of *L. taxifolium*), and their tubulose condition is not affected by water.

Agreeing closely with the type are the following additional specimens, both in the U. S. National Herbarium:

COSTA RICA: From tree trunks along the Agua Caliente, Finca Navarro, alt. 1,350 meters, May 21 to 23, 1906, *Maxon* 695. La Palma (on the Atlantic slope), alt. about 1,520 meters, July 22, 1888, *Pittier* 272.

EXPLANATION OF PLATE 10.—Apical portion of one of the type specimens of *Lycopodium tubulosum*. Natural size.

### A NEW CYATHEA FROM SANTO DOMINGO.

There have recently been described by Brause<sup>1</sup> five new species of *Cyathea* from the West Indies, as follows: *Cyathea tenuis* from Cuba, and *Cyathea urbani*, *C. hieronymi*, *C. domingensis*, and *C. irregularis* from Santo Domingo. These, which appear to be valid, with the

<sup>1</sup> In Urban, *Symb. Antill.* 7: 151-155. 1911.





LYCOPodium TUBULOSUM MAXON.



following single new species, make a total of forty-nine to be recognized from North America.<sup>1</sup>

***Cyathea asperula* Maxon, sp. nov.**

Caudex, stipes, and shape of lamina unknown; lamina presumably about 2 meters long, 70 cm. broad, deeply tripinnatifid, the primary rachis slender (about 4 mm. thick), olivaceous, minutely and deciduously furfuraceous, sparingly beset with small slender straight spines about 0.5 to 1 mm. long; pinnæ subopposite, sessile, oblong, abruptly acuminate, 30 to 35 cm. long, 11 to 14 cm. broad, the secondary rachis slender, yellowish brown, strigose above, below scabrous or asperulous only toward the base, the spines very minute; pinnules about 18 pairs, narrowly oblong, long-acuminate to subcaudate, 5 to 7 cm. long, 15 to 18 mm. broad, contiguous or nearly so, subsessile, spreading, cut nearly to the costa at the base, less deeply outward, the costal wing about 1 mm. broad upon each side toward the apex, the costa slender, laxly strigose above, below bearing numerous minute strongly bullate roundish bright brown scales (with slender long-pointed tips) and toward the base a few linear scales (1 to 1.5 mm. long) with minutely fimbriate margins, the teeth mostly gland-tipped; segments 12 to 14 pairs, slightly falcate, obtuse, 8 to 10 mm. long, 3.5 to 4 mm. broad, the basal pair constricted and apart, coarsely incised and commonly semihastulate upon the proximal margin, the others not constricted, slightly dilatate, separated by narrow linear sinuses, the margins lightly serrate-crenate; costules slender, bearing 3 or 4 spine-like hairs above, below bearing numerous minute bullate scales (like those of the costa) and a few distant curved hairs; veins 6 to 8 pairs, oblique, mostly once forked; sori nearly medial; indusium globose, yellowish brown, delicately membranous, rupturing irregularly, the divisions subpersistent on all sides; receptacle capitate, conspicuously setiferous.

Type in the U. S. National Herbarium, no. 690466, collected in forests near Constanza, Santo Domingo, altitude 1,250 meters, March, 1910, by H. von Türckheim (no. 3056); distributed as *Cyathea muricata* Willd.

*Cyathea asperula* is an exceedingly well marked species. From *Cyathea tenera* (J. Smith) Griseb., which has similarly muricate or minutely spiny rachises, it differs in its copious covering of bullate scales upon the costa and costules, and in being nearly devoid of hairs below (instead of strongly pubescent upon the costæ, costules, and veins), as well as in its fewer pinnules, fewer and differently shaped segments, and in other obvious characters.

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<sup>1</sup> See N. Amer. Fl. 16: 65-88. 1909.



# MEXICAN GRASSES IN THE UNITED STATES NATIONAL HERBARIUM.

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By A. S. HITCHCOCK

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## INTRODUCTION.

The following list of grasses, based entirely upon specimens in the United States National Herbarium, is a preliminary paper, in which the scattered data upon Mexican grasses have been brought together and arranged in a convenient form. The species included have been accepted, for the most part, in their traditional sense. It has been impracticable to examine the types of many of the earlier described species since these specimens are located in European herbaria. For this reason the synonymy has been confined mostly to those names that could be fixed by an examination of American types, or concerning the application of which there was little doubt. The largest number of unidentified names are found in Fournier's work on Mexican grasses.<sup>1</sup> This results from the incomplete or unsatisfactory descriptions and from the fact that the specimens cited under a given species either may not agree with the diagnosis, or may belong to two or more species, at least in different herbaria. An examination of the original specimens will undoubtedly lead to the identification of the greater part of these names.

There are several specimens that have been omitted from the list because they have not been identified and are apparently undescribed species. They belong to genera, however, that are much in need of critical revision and further study of them is deferred for the present. In subsequent articles it is hoped to work out the classification of the tropical American grasses upon a type basis.

## KEY TO THE GENERA.

Spikelets with one perfect terminal floret, and usually  
a second staminate or neutral floret below  
(lower floret perfect in *Isachne*); rachilla articulated below the glumes, the spikelets fall-

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Fournier, Eug. *Mexicanas Plantas. Pars secunda. Gramineae.* 1886. For discussion of the date of publication of this work see *Contr. U. S. Nat. Herb.* 15: 49. 1910 and op. cit. 14: 350. 1912.



ing from the pedicels entire, singly, in groups, or together with joints of an articulate rachis; spikelets, or at least the fruits, not laterally compressed (except in *Lithachne*).

Lemma and palea (the latter sometimes wanting in *Andropogoneae*) hyaline; glumes more or less indurated, the first largest; sterile lemma like the fertile in texture.

Plants monœcious. (MAYDEAE.)

Staminate spikes in a terminal panicle; pistillate spikes in the axils of the leaves, sometimes bearing also staminate spikes.....

1. *EUCHLAENA* (p. 195).

Staminate and pistillate florets in the same spike, the staminate uppermost.

Spikes digitate, the rachis of pistillate portion bony-indurated, disarticulating with spikelets attached.....

2. *TRIPSACUM* (p. 195).

Spikes paniculate, the pistillate spikelets inclosed in ovoid pearly or grayish, bead-like bodies, the staminate portion protruding from a small orifice.....

3. *COIX* (p. 196).

Plants not monœcious, but the inflorescence often consisting of staminate or neutral spikelets intermixed with perfect ones. (ANDROPOGONEAE.)

Spikelets all alike, perfect; inflorescence conspicuously hairy.

Rachis of spike continuous; inflorescence a narrow spike-like panicle; spikelets awnless...

4. *IMPERATA* (p. 197).

Rachis breaking up into joints.

Spikelets awned; inflorescence a narrow or open panicle.

6. *ERIANTHUS* (p. 197).

Spikelets awnless; inflorescence a dense interrupted golden brown spike-like panicle.....

5. *ERIOCHRYSIS* (p. 197).

Spikelets not alike, part perfect and part staminate or neutral.

Joints of the rachis much thickened and excavated, the spikelets fitting into the recesses.

First glume of perfect spikelet hemispherical, pitted; plants annual.....

10. *RYTILIX* (p. 198).

First glume of perfect spikelet flat or somewhat convex; plants perennial.



- Racemes cylindric, readily disarticulating..... 9. COELORACHIS (p. 198).
- Racemes flattened, tardily disarticulating..... 8. HEMARTHRIA (p. 197).
- Joints of rachis not greatly thickened nor with excavations.
- Spikelets 2-flowered; racemes several, corymbose..... 7. ISCHAEMUM (p. 197).
- Spikelets 1-flowered.
- Spikelets all pedicellate, the pistillate with long feathery awns; axis indistinctly articulate... 11. TRACHYPOGON (p. 198).
- Spikelets sessile and pedicellate; axis distinctly articulate.
- Racemes solitary, terminating the culm, the spikelets awnless; first glume with a balsam-bearing line within the side keels 12. ELYONURUS (p. 199).
- Racemes 1 to many, sometimes reduced to the terminal joint of 3 spikelets, if solitary the spikelets awned.
- Sessile spikelets not all alike, some of the lower differing from the upper and bearing a short awn.
- Racemes solitary, terminating the culm or its branches, the awns long, becoming entangled..... 17. HETEROPOGON (p. 212).
- Racemes in pairs from a boat-shaped sheath, the short awns not becoming entangled..... 14. CYMBOPOGON (p. 209).
- Sessile spikelets all alike.
- Inflorescence consisting of 1 to many racemes, the spikelets arranged in pairs,



- one sessile and perfect, the other pedicellate and staminate, neutral, or reduced to a scale or to the pedicel 13. *ANDROPOGON* (p. 200).
- Inflorescence compound, paniculate, the racemes reduced to 2 to 5 spikelets.
- Pedicellate spikelets staminate 15. *HOLCUS* (p. 209).
- Pedicellate spikelets reduced to the pedicel... 16. *SORGHASTRUM* (p. 210).
- Lemma and palea membranaceous or cartilaginous, not more delicate than the glumes.
- Lemma and palea membranaceous, resembling the glumes in texture.
- Spikelets paniculate, consisting of 1 perfect terminal floret bearing a geniculate or twisted awn, with a sterile floret below.. 25. *ARUNDINELLA* (p. 217).
- Spikelets single or in groups along a continuous axis forming a spike or raceme, or in the axils of the upper sheaths. (*ZOYSEAE*.)
- Glume 1, 3 to 5-awned; spikelets clustered in the axils of the upper sheaths..... 23. *SCHAFFNERELLA* (p. 217).
- Glumes 2; spikelets solitary or in groups at each joint of the main axis, the groups falling off entire.
- Spikelets solitary; plants monœcious or dioecious, creeping..... 24. *FOURNIERA* (p. 217).
- Spikelets in groups.
- Groups of spikelets surrounded by an indurated false involucre formed by the first glumes of each spikelet..... 18. *ANTHEPHORA* (p. 213).
- Groups of spikelets not involucre.
- Second glume coriaceous, bearing hooked spines on the back..... 22. *NAZIA* (p. 216).
- Second glume not spiny.
- Groups of spikelets spreading or drooping, borne along one side of the delicate axis; lowest spikelet sterile, the terminal fertile..... 21. *ÆGOPOGON* (p. 215).
- Groups of spikelets erect or appressed on both sides of the rather stout axis; central spikelet fertile, the two lateral staminate.



- Plants stoloniferous..... 19. *HILARIA* (p. 213).
- Plants producing rhizomes but  
not stoloniferous..... 20. *PLEURAPHIS* (p. 214).
- Lemma and palea indurated, coriaceous or  
chartaceous, firmer than the glumes.  
(PANICEAE.)
- Spikelets unisexual; fruit bony-indurated.
- Panicles terminal on culms or leafy  
branches, the pistillate spikelets  
above, the staminate below in the  
same panicle..... 51. *OLYRA* (p. 271).
- Panicles all axillary or axillary and ter-  
minal, the terminal when present  
wholly staminate.
- Fruit laterally compressed, conspic-  
uously gibbous on upper dorsum.... 52. *LITHACHNE* (p. 272).
- Fruit dorsally compressed, lanceolate... 53. *RADDIA* (p. 272).
- Spikelets perfect (one of a pair sometimes  
abortive).
- Axis broad and corky, the spikelets sunken  
in its cavities, the terminal portion  
disarticulating at maturity..... 50. *STENOTAPHRUM* (p. 271).
- Axis not broad and corky, the spikelets not  
sunken in cavities.
- Spikelets subtended or surrounded by 1  
to many bristles or spines (sterile  
branchlets), these distinct or more  
or less connate at base, forming a  
false involucre.
- Bristles falling with the spikelet at  
maturity.
- Bristles more or less united at base  
into a bur-like involucre ..... 49. *CENCHRUS* (p. 268).
- Bristles not united at base, usually  
slender, often plumose..... 48. *PENNISSETUM* (p. 265).
- Bristles of involucre persistent, the  
spikelets deciduous.
- Sterile palea at maturity becoming  
cartilaginous and winged, much  
exceeding the spikelet in width;  
spikelets secund along the  
branches of a simple panicle,  
each subtended by a single  
viscid bristle..... 47. *IXOPHORUS* (p. 265).
- Sterile palea not enlarged at ma-  
turity.
- Second glume and sterile lemma  
very broad, many-nerved,  
the glume saccate, auriculate,  
the lemma lyre-shaped, indu-  
rated on the margins; spike-  
let subtended by a single  
flexuous bristle..... 45. *SETARIOPSIS* (p. 259).



- Second glume and sterile lemma  
neither many-nerved, saccate,  
auriculate, nor lyre-shaped;  
subtending bristles 1 to many. 46. *CHAETOCHLOA* (p. 259).
- Spikelets not subtended nor surrounded  
by bristles (axis of branchlet ex-  
tending beyond the base of the  
uppermost spikelet as a point or  
bristle in *Panicum*, subgenus  
*Paurochaetium*).
- Fruit cartilaginous-indurated, not  
rigid, papillose, usually dark-  
colored, the more or less prom-  
inent white hyaline margins of the  
lemma not inrolled.
- Fruit open at the hyaline summit. 26. *LEPTOCORYPHIUM* (p. 218).
- Fruit not open at summit.
- Fruit lanceolate, acuminate; sec-  
ond glume and sterile lemma  
usually long-silky. 27. *VALOTA* (p. 218).
- Fruit elliptic; pubescence short  
or none.
- Inflorescence of slender ra-  
cemes, digitately or sub-  
digitately arranged. 28. *SYNTHERISMA* (p. 219).
- Inflorescence a capillary pan-  
icle. 29. *LEPTOLOMA* (p. 222).
- Fruit indurated, rigid (or if thin the  
lemma not hyaline-margined).
- Spikelets (or the primary one of a  
pair) placed with the back of  
the fruit turned away from the  
rachis, usually solitary.
- First glume as long as the spikelet  
or nearly so; spikelets in  
pairs, the secondary usually  
aborted, sometimes wanting,  
strongly tuberculate-hispid or  
uncinate at maturity, later-  
ally compressed, in unilateral  
racemes. 30. *ECHINOLAENA* (p. 223).
- First glume obsolete or not over  
one-fourth the length of the  
spikelet.
- Rachilla joint and first glume  
forming a swollen ring-like  
callus below the spikelet,  
the glume reduced to an ad-  
nate sheath of the rachilla  
joint; fruit mucronate or  
awn-tipped. 31. *ERIOCHLOA* (p. 223).
- Rachilla joint not forming a  
ring-like callus below the  
spikelet; first glume pres-  
ent or wanting.



- First glume present; racemes  
racemose along the main  
axis..... 32. BRACHIARIA (p. 224).
- First glume wanting; racemes  
digitate or subdigitate... 33. AXONOPUS (p. 225).
- Spikelets placed with the back of  
the fruit turned toward the  
rachis of the spike-like racemes,  
or pedicellate in panicles.
- First glume typically wanting  
(present in some of the spike-  
lets in certain species); spike-  
lets plano-convex, subsessile  
in spike-like racemes..... 34. PASPALUM (p. 226).
- First glume present; spikelets  
usually in panicles.
- Glumes or lemmas or both  
awned or, if short-pointed  
only (*Echinochloa colonum*),  
the summit of the fertile  
palea not inclosed.
- Glumes 2-lobed, awned from  
between the lobes; inflo-  
rescence of several uni-  
lateral racemes along a  
common axis..... 42. OPLISMENUS (p. 255).
- Glumes entire, awned from  
the tip or only mucronate.
- Inflorescence of several  
more or less compound  
unilateral racemes;  
spikelets ovate, not  
having a callus-like  
base..... 43. ECHINOCHLOA (p. 256).
- Inflorescence a narrow,  
almost spike-like pan-  
icle; spikelets lanceo-  
late, with a long callus-  
like base below the  
long-awned glumes.... 44. CHAETIUM (p. 259).
- Glumes and lemmas awnless.
- Spikelets typically with 2  
fertile florets; inflores-  
cence a panicle..... 41. ISACHNE (p. 254).
- Spikelets with a single fertile  
floret.
- Glumes equal, inclosing the  
rest of the dorsally  
compressed spikelet;  
margins of the fertile  
lemma flat..... 40. HOMOLEPIS (p. 254).
- Glumes not equal nor en-  
tirely inclosing the  
spikelet.



Fruit membranaceous,  
the palea not in-  
closed above; spike-  
lets lanceolate, sub-  
sessile in usually  
spike-like panicles.. 39. HYMENACHNE (p. 254).

Fruit chartaceous-indu-  
rated, the palea in-  
closed (rarely the tip  
free).

Second glume inflated-  
saccate, many-  
nerved, this and  
the sterile lemma  
much exceeding  
the stipitate fruit;  
panicle spike-like. 38. SACCIOLEPIS (p. 254).

Second glume not in-  
flated-saccate; pan-  
icles not spike-like.

Culms usually woody,  
bamboo-like;  
spikelets globose,  
large, the glumes  
and sterile lem-  
ma papery; fruit  
bony-indurated,  
a downy tuft at  
apex..... 37. LASIACIS (p. 251).

Culms not woody nor  
bamboo-like.

Fertile lemma  
either with  
lateral append-  
ages or exca-  
vations at base,  
the margins  
usually not in-  
rolled; first  
glume large;  
blades usually  
petiolate..... 36. ICHNANTHUS (p. 250).

Fertile lemma  
with neither  
lateral ap-  
pendages nor  
excavations at  
base, the in-  
rolled mar-  
gins clasping  
the palea; in-  
florescence  
typically pa-  
nicate ..... 35. PANICUM (p. 241).



Spikelets 1 to many-flowered, the imperfect or rudimentary floret, if any, uppermost (except in Phalarideae); rachilla articulated above the persistent glumes (except in Oryzeae, Cinna, Polypogon, Sphenopholis, and Spartina); spikelets usually laterally compressed.

Culms woody; blades often with a short petiole articulated with the sheath. (BAMBUSEAE.)

Stamens 6..... 133. BAMBOS (p. 387).

Stamens 3.

Spikelets 1-flowered..... 132. CHUSQUEA (p. 387).

Spikelets 2 to many-flowered.

Glumes 1 or 2; sterile lemmas none; spikelets loose, many-flowered, elongated, paniculate or racemose..... 130. ARUNDINARIA (p. 386).

Glumes 2; sterile lemmas 1 or 2; spikelets in racemes or one-sided spikes, these arranged in tufts at the culm nodes..... 131. ARTHROSTYLIDIUM (p. 387).

Culms herbaceous.

Spikelets in two close rows, sessile or nearly so, forming a one-sided spike (in Bulbilis only the staminate so). (CHLORIDEAE.)

Spikelets monœcious or diœcious, the two sexes very unlike.

Pistillate inflorescence capitate; staminate spikelets 2 or 3-flowered..... 96. BULBILIS (p. 352).

Pistillate inflorescence a loose spike; staminate spikelets 1-flowered.

First glume of pistillate spikelet very small; lemma of fertile floret with 3 long awns..... 97. OPIZIA (p. 353).

First glume of pistillate spikelet somewhat shorter than the second; lemma of fertile floret 3-toothed..... 98. PRINGLEOCHLOA (p. 353).

Spikelets all alike, bearing perfect florets and often more or less rudimentary ones above.

Spikelets with 2 or more perfect florets.

Spikes digitately arranged.

Rachis extended beyond the spikelets as a point..... 93. DACTYLOCTENIUM (p. 347).

Rachis not extended..... 92. ELEUSINE (p. 346).

Spikes solitary or racemosely arranged.

Inflorescence a single spike-like raceme. 91. TRIPOGON (p. 346).

Inflorescence of several racemose spikes or spike-like racemes.

Racemes spikelet-bearing from the base; lemmas glabrous or only slightly pubescent..... 94. LEPTOCHLOA (p. 348).

Racemes naked below; lemmas villous on the nerves or callus..... 95. GOUINIA (p. 351).

Spikelets with one perfect floret.

Spikelets bearing no sterile lemmas above the perfect floret, awnless.



- Spikelets articulated below the glumes;  
spikes several, racemose..... 84. SPARTINA (p. 329).
- Spikelets not articulated below the  
glumes.  
Spike solitary..... 82. MICROCHLOA (p. 328).  
Spikes few, digitate..... 83. CAPRIOLA (p. 329).
- Spikelets bearing sterile lemmas above the  
fertile floret.  
Spikes solitary or approximate.  
Sterile lemmas below the fertile  
floret 2..... 85. CAMPULOSUS (p. 330).  
Sterile lemmas below the fertile  
floret none.  
Fertile lemma 1-awned or awnless.. 86. CHLORIS (p. 330).  
Fertile lemma 3-awned..... 87. TRICHLORIS (p. 334).
- Spikes several, racemose.  
Spikelets usually numerous, normally  
all alike; spikes usually oblong  
or linear..... 88. BOUTELOUA (p. 335).
- Spikelets 1 to 3, normally of two forms  
in each spike (usually alike in  
*Pentarrhaphis polymorpha*); spikes  
triangular in outline.  
Spikelets 2, one of them reduced to a  
cluster of awns (or both devel-  
oped in *P. polymorpha*); sterile  
floret 1..... 90. PENTARRHAPHIS (p. 346).
- Spikelets 3, the lateral staminate or  
rudimentary, smaller than the  
terminal; sterile florets 2 or more 89. CATHESTECUM (p. 345).
- Spikelets paniculate or spicate, but not in one-  
sided spikes.  
Spikelets sessile on opposite sides of a zigzag  
jointed channeled rachis forming a spike.  
Plants dioecious; fertile spike corniculate... 125. JOUEA (p. 384).  
Plants not dioecious.  
Spikelets solitary at each node of the rachis.  
Spikelets placed edgewise to the rachis.. 124. LOLIUM (p. 383).  
Spikelets placed flatwise to the rachis... 126. AGROPYRON (p. 384).
- Spikelets 2 or 3 at each node of the rachis.  
Spikelets 1-flowered, not all alike, the  
lateral pair pediceled, usually abor-  
tive..... 127. HORDEUM (p. 385).
- Spikelets 2 to 6-flowered, all alike.  
Axis of spike continuous, not disar-  
ticulating at maturity; glumes  
broad or narrow but not greatly  
elongated..... 128. ELYMUS (p. 385).
- Axis of spike disarticulating at ma-  
turity; glumes setaceous, elon-  
gated..... 129. SITANION (p. 386).
- Spikelets in open or spike-like panicles.



**Spikelets 1-flowered, sometimes with sterile lemmas below or with a rudiment of a second floret above.**

**Spikelets monœcious.**

Spikelets in pairs at the nodes of the panicle-branches, one large, pistillate, sessile, the other small, staminate, long-pediceled; lemma cylindrical-oblong.....

54. PHARUS (p. 272).

Spikelets not in pairs, ovate; glumes none.....

55. LUZIOLA (p. 272).

**Spikelets perfect.**

**Sterile lemmas below fertile floret 2.**

Sterile lemmas reduced to small scales; panicle ovate or oblong, spike-like

57. PHALARIS (p. 273).

Sterile lemmas mostly as large as the fertile; panicle somewhat open, bronze-colored.....

58. SAVASTANA (p. 274).

**Sterile lemmas none.**

Spikelets strongly laterally compressed; glumes none.....

56. HOMALOCENCHRUS (p. 272).

Spikelets often laterally compressed but not strongly flattened; glumes usually present. (AGROSTIDEAE.)

**Lemma firmer than the glumes, indurated, awned and provided with a strong callus.**

**Lemma 3-awned (the lateral awns short or wanting in some species, but in these the central awn not geniculate or twisted)**

59. ARISTIDA (p. 274).

**Lemma 1-awned.**

Awn dorsal..... 64. TRINIOCHLOA (p. 303).

**Awn terminal.**

Lemma narrow, oblong or linear; awn stout, geniculate, twisted, persistent..

60. STIPA (p. 281).

Lemma short and broad; awn slender, more or less deciduous, straight, or curved, scarcely geniculate and twisted.

Lemma not gibbous at the summit.....

61. ORYZOPSIS (p. 285).

Lemma obovate, gibbous at the summit, the awn eccentric.....

62. PIPTOCHAETIUM (p. 286).

**Lemma more delicate than the glumes or of about the same texture.**

**Spikelets articulated below the glumes.**



- Spikelets in pairs, one perfect,  
the other staminate or neuter,  
the branchlets deciduous..... 65. *LYCURUS* (p. 304).
- Spikelets not in pairs.  
Glumes awned; lemma with a  
long slender terminal awn 71. *POLYPOGON* (p. 317).
- Glumes awnless; lemma with  
a short straight awn below  
the apex..... 72. *CINNA* (p. 317).
- Spikelets not articulated below  
the glumes.  
Spikelets with several bristles  
below the glumes; lemma  
long-awned..... 66. *PEREILEMA* (p. 305).
- Spikelets with no bristles below.  
Glumes strongly compressed,  
longer than the lemma;  
inflorescence a dense  
spike-like panicle..... 67. *PHLEUM* (p. 306).
- Glumes not strongly compressed.  
Lemma and palea much  
more delicate than the  
glumes, the palea  
shorter than the lemma,  
often wanting..... 73. *AGROSTIS* (p. 318).
- Lemma and palea of about  
the same texture as the  
glumes and as long or  
longer.  
Lemma with a tuft of  
hairs at base, the  
awn dorsal; rachilla  
usually prolonged... 74. *CALAMAGROSTIS* (p. 321).
- Lemma without a tuft of  
hairs at base or the  
hairs very short.  
Glumes obtuse, equal,  
as long as the lemma;  
inflorescence elongated,  
usually a narrow or spike-  
like panicle..... 70. *EPICAMPES* (p. 314).
- Glumes shorter than  
the lemma, often  
unequal.  
Lemmas awned or  
mucronate..... 63. *MUHLENBERGIA* (p. 286).
- Lemmas awnless.  
Nerves of lemma  
silky-villous.. 69. *BLEPHARONEURON* (p. 314).
- Nerves of lemma  
glabrous..... 68. *SPOROBOLUS* (p. 306).



**Spikelets 2 to many-flowered.**

Lemma of lower floret usually shorter than the glumes, usually with a bent awn on the back (*Koeleria* and *Sphenopholis* awnless); rachilla produced. (AVENEAE.)

Articulation below the glumes..... 77. *SPHENOPHOLIS* (p. 326).

Articulation above the glumes.

Lemmas awnless; acuminate..... 78. *KOELERIA* (p. 326).

Lemmas awned.

Awns flattened, from between the lobes of the lemma.

Spikelets in clusters of 3, 2-flowered, the upper floret fertile, the lower staminate..... 80. *TRISTACHYA* (p. 327).

Spikelets solitary, 3 to many-flowered, all the florets fertile, or the uppermost sterile..... 81. *DANTHONIA* (p. 328).

Awns not flattened, dorsal.

Spikelets more than 1 cm. long; plants annual..... 79. *AVENA* (p. 327).

Spikelets less than 1 cm. long.

Lemmas keeled; awn from above the middle..... 76. *TRisetum* (p. 323).

Lemmas convex; awn from below the middle..... 75. *DESCHAMPSIA* (p. 322).

Lemma of lower floret usually longer than the glumes; awn when present usually straight and terminal. (FESTUCEAE.)

Lemma 3 to many-cleft.

Plants dioecious..... 101. *SCLEROPOGON* (p. 354).

Plants hermaphrodite.

Spikelets in short spike-like racemes..... 104. *ORCUTTIA* (p. 355).

Spikelets in panicles.

Divisions of lemma awn-like; panicle contracted..... 99. *PAPPOPHORUM* (p. 353).

Divisions of lemma membranaceous, awned; panicle open.. 100. *COTTEA* (p. 354).

Lemma entire or 2-cleft.

Rachilla or lemma (at least of the fertile floret) bearing long hairs, as long as the lemma; tall, reed-like grasses.

Plants dioecious..... 105. *GYNERIUM* (p. 355).

Plants hermaphrodite.

Rachilla naked; lemmas hairy... 106. *ARUNDO* (p. 355).

Rachilla hairy; lemmas naked... 107. *PHRAGMITES* (p. 356).

Rachilla and lemmas naked or hairy, but the hairs shorter than the lemmas.

Spikelets concealed in the leaves.

Plants dioecious; a creeping perennial..... 102. *MONANTHOCLOË* (p. 354).



- Plants hermaphrodite; a tufted annual..... 103. MUNROA (p. 355).
- Spikelets in a more or less exserted inflorescence.
- Spikelets of two forms, perfect and sterile, in the same inflorescence, fasciculate in small one-sided panicles..... 117. ACHYRODES (p. 372).
- Spikelets all alike in the same inflorescence.
- Styles wiry, spirally twisted, the long terete spikelets becoming entangled above; inflorescence an elongated one-sided raceme..... 113. STREPTOGYNE (p. 370).
- Styles not wiry nor twisted.
- Blades broad, ovate or elliptical, with fine transverse veins between the longitudinal nerves, petiolate; inflorescence paniculate.
- Spikelets several-flowered, the lower floret perfect, unlike the upper staminate florets; glumes broad at summit..... 111. SENITES (p. 368).
- Spikelets 1-flowered, with a long prolongation of the rachilla; panicle capillary..... 112. ORTHOCLADA (p. 370).
- Blades linear, not transversely veined.
- Lemmas 3-nerved.
- Lemmas 3-toothed, pilose on the nerves and callus..... 108. TRIDENS (p. 356).
- Lemmas glabrous, entire. 109. ERAGROSTIS (p. 358).
- Lemmas 5 to several-nerved.
- Plants dioecious..... 115. DISTICHLIS (p. 371).
- Plants hermaphrodite (except in a few species of Poa).
- Spikelets broad, cordate; lemmas cordate..... 116. BRIZA (p. 371).
- Spikelets not broad and cordate.
- Glumes large, scarious - margined, membranaceous; upper florets 2 or 3; lemmas empty, convolute around each other..... 110. MELICA (p. 367).



Glumes not scarious-  
margined.

Sterile lemmas at  
base of spike-  
let several.... 114. *UNIOLA* (p. 370).

Sterile lemmas at  
base of spike-  
let none. (See  
continuation.)

(CONTINUATION.)

Lemmas keeled, awnless..... 118. *POA* (p. 372).

Lemmas convex, or keeled toward the summit.

Rachilla and callus villous..... 119. *GRAPHEPHORUM* (p. 376).

Rachilla and callus not villous, sometimes pubes-  
cent.

Nerves of lemma prominent, parallel..... 120. *PANICULARIA* (p. 376).

Nerves of lemma not prominent, often faint,  
converging at the summit.

Spikelets in a mostly simple raceme;  
palea pectinate-fringed..... 123. *BRACHYPODIUM* (p. 383).

Spikelets paniced; palea not pectinate-  
fringed.

Lemmas not toothed at summit, usu-  
ally awned, the awn terminal. 121. *FESTUCA* (p. 376).

Lemmas toothed at summit, the awn  
from between the teeth..... 122. *BROMUS* (p. 380).

### ANNOTATED LIST OF THE SPECIES.

1. **EUCHLAENA** Schrad. Sem. Hort. Goettingen 1832; reprinted in *Linnaea* 8:  
Litt. 25. 1833.

1. **Euchlaena mexicana** Schrad. Sem. Hort. Goettingen 1832; reprinted in *Linnaea*  
8: Litt. 25. 1833. TEOSINTE.

Type locality, "Mexico."

RANGE: Durango to Jalisco, Oaxaca, and Chiapas.

HERBARIUM SPECIMENS:

DURANGO: Durango, along water ditches, *Palmer* 743 in 1896.

JALISCO: Zapotlán, prairie along railroad, *Hitchcock* 7146.

MICHOACÁN: Queréndaro, rocky hills, *Pringle* 4319.

OAXACA: San Agustín, in arena fluvii exsiccati prope mare Pacificum, *Lieb-  
mann* 548.

CHIAPAS: Tuxtla Gutiérrez, *Collins & Doyle* 102.

2. **TRIPSACUM** L. Syst. Nat. ed. 10. 1261. 1759.

#### KEY TO THE SPECIES.

Blades narrow, usually less than 12 mm. wide; plants usually 1 to

1.5 meters high..... 1. *T. lanceolatum*.

Blades wide, usually 5 to 7 cm.; plants tall and stout as much as

2.8 meters high.

Sheaths glabrous..... 2. *T. laxum*.

Sheaths hispid..... 3. *T. pilosum*.



**1. *Tripsacum lanceolatum* Rupr.; Fourn. Mex. Pl. 2: 68. 1886.**

Type locality, "Aguas Calientes," the station where Hartweg collected the specimen named *T. lanceolatum* by Ruprecht. The name was first mentioned without description by Bentham,<sup>1</sup> Hartweg's no. 252 being cited.

RANGE: Lower California and Chihuahua to southern Mexico.

**HERBARIUM SPECIMENS:**

LOWER CALIFORNIA: Sierra de San Francisquito, *Brandege* in 1899. El Toste, *Brandege* in 1902.

SONORA: High up in Sierra de Alamos, *Rose, Standley & Russell* 13080. Guadalupe Canyon, *International Bound. Com.* 2035.

CHIHUAHUA: Sánchez, rocky ravine, *Hitchcock* 7702.

DURANGO: Durango, on Iron Mountain, a rocky hill, *Hitchcock* 7630, 7648; in deep rich soil among the higher hills, *Palmer* 537 in 1896.

SAN LUIS POTOSÍ: Las Canoas, rocky hills, *Pringle* 3811. Bagre, *Purpus* 5433.

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7358. Río Blanco, *Palmer* 509 in 1886. Between Huejuquilla and Mezquitic, *Rose* 3570.

COLIMA: Manzanillo, large bunches on rocky cliff by seashore, *Hitchcock* 7046. Alzada, rocky hillside, *Hitchcock* 7082; shady ravine, *Hitchcock* 7083.

MICHOACÁN: Morelia, *Arsène* in 1909.

GUANAJUATO: Jaral, *Schumann* 1718.

FEDERAL DISTRICT: Tacubaya, copse at edge of field, *Hitchcock* 5909; *Holway* 8.

MORELOS: Cuernavaca, rocky cliff, *Hitchcock* 6840.

GUERRERO: Balsas, on rocks of cliff, *Hitchcock* 6816.

OAXACA: Oaxaca, rocky cliff, *Hitchcock* 6160. Villa Alta, *Liebmann* 547.

**2. *Tripsacum laxum* Nash, N. Amer. Fl. 17: 81. 1909.**

Type locality, "Hacienda de la Laguna [Veracruz] Mexico."

RANGE: Southern Mexico.

**HERBARIUM SPECIMENS:**

COLIMA: Alzada, in large bunches, 6 to 8 feet high, on a rocky grassy hillside, *Hitchcock* 7103.

VERACRUZ: Mirador, *Liebmann* 549. Río Blanco, *Bourgeau* 3138.

**3. *Tripsacum pilosum* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 6. f. 1. 1901.**

Type locality, "Between Colotlán and Bolaños, State of Jalisco," the type specimen collected by *Rose* (no. 2841).

RANGE: Southwestern Mexico.

**HERBARIUM SPECIMENS:**

DURANGO: Sierra Madre, *Rose* 3513.

JALISCO: Guadalajara, Barranca de Oblatos, on open rocky hillside, *Hitchcock* 7343, 7361, 7366. Río Blanco, *Palmer* 508 in 1886; *Rose & Hay* 6278. Between Colotlán and Bolaños, *Rose* 2841.

COLIMA: Alzada, steep hillside in ravine, open, grassy ground among rocks, *Hitchcock* 7088.

**3. *COIX* L. Sp. Pl. 972. 1753.****1. *Coix lacryma-jobi* L. Sp. Pl. 972. 1753.**

JOB'S TEARS.

Type locality in East Indies.

RANGE: Tropics of both hemispheres, introduced in the New World.

**HERBARIUM SPECIMEN FROM MEXICO:**

COAHUILA: Saltillo, *Palmer* 1337 in 1880.

<sup>1</sup> Pl. Hartw. 347. 1857.



4. **IMPERATA** Cyril. Pl. Rar. Icon. 2: 26. pl. 11. 1792.

## KEY TO THE SPECIES.

Panicle 7 to 10 cm. long, rather loose; hairs about twice as long as spikelet ..... 1. *I. brasiliensis*.

Panicle usually 20 to 25 cm. long, dense; hairs longer..... 2. *I. hookeri*.

1. **Imperata brasiliensis** Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 2: 331. 1833.

Type locality in Brazil.

RANGE: Southern Mexico to Brazil.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Mirador, *Liebmann* 86. Sanborn, *Orcutt* 3075.

2. **Imperata hookeri** Rupr.; Anderss. Öfv. Vet. Akad. Förh. 12: 160. 1855.

Type locality "in Texas," the type specimen collected by Drummond (ser. II. no. 283).

RANGE: Southwestern United States to Jalisco.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Desert canyon in northern part of territory, *Orcutt* in 1884.

SONORA: Hermosillo, bank of ditch, *Hitchcock* 3610; *Brandegge* 77.

JALISCO: Río Blanco, *Palmer* 444 in 1886.

5. **ERIOCHRYSIS** Beauv. Ess. Agrost. 8. pl. 4. f. 11. 1812.

1. **Eriochrysis cayennensis** Beauv. Ess. Agrost. 8. pl. 4. f. 11. 1812.

Type locality presumably Cayenne. (Beauvois spells the specific name "cayennensis.")

RANGE: Tropical America.

HERBARIUM SPECIMENS FROM MEXICO:

OAXACA: Trapiche de la Concepción, *Liebmann* 2.

CHIAPAS: Ocuilapa, *Nelson* 3063.

6. **ERIANTHUS** Michx. Fl. Bor. Amer. 1: 54. 1803.

1. **Erianthus trinii** Hack. in DC. Monogr. Phan. 6: 135. 1889.

Type locality in Brazil.

RANGE: Mexico to Brazil.

HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Tamasopo Canyon, mountain side, *Pringle* 3135.

VERACRUZ: Borrego near Orizaba, *Bourgeau* 2970. Orizaba, open rocky hill, *Hitchcock* 6379. Mirador, *Liebmann* 38.

7. **ISCHAEMUM** L. Sp. Pl. 1049. 1753.

1. **Ischaemum latifolium** (Spreng.) Kunth, Rév. Gram. 1: 168. 1829.

*Andropogon latifolius* Spreng. Syst. Veg. 1: 286. 1825.

Type locality, "Guadalupa, Martinica," West Indies.

RANGE: Mexico and the West Indies to Brazil.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Under spray of a waterfall in the barranca of Texolo near Jalapa, *Pringle* 8106. Fortín, *Kerber* 296. Córdoba, *Bourgeau* 2203. Mirador, *Liebmann* 9, 13.

8. **HEMARTHRIA** R. Br. Prodr. Fl. Nov. Holl. 207. 1810.

1. **Hemarthria fasciculata** (Lam.) Kunth, Rév. Gram. 1: 453. 1829.

*Rottboellia fasciculata* Lam. Tabl. Encycl. 1: 204. 1791.

Type locality, "Barbaria."



RANGE: Warmer regions of the Old World, introduced in the American tropics.

HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Tamasopo Canyon, river ledges, *Pringle* 3132. Rascón, *Palmer* 654 in 1905.

MORELOS: Jojutla, *Pringle* 9610.

9. **COELORACHIS** Brongn. in Duperrey, Bot. Voy. Coquille 64. *pl.* 14. 1829.

1. **Coelorachis ramosa** (Fourn.) Nash, N. Amer. Fl. 17: 86. 1909.

*Apogonia ramosa* Fourn. Mex. Pl. 2: 63. 1886.

Type locality in Veracruz, three localities being cited, "Rio Blanco, \* \* \* Orizaba, \* \* \* Mirador."

RANGE: Eastern Mexico.

HERBARIUM SPECIMENS:

VERACRUZ: Jalapa, low ground, among high vegetation, *Hitchcock* 6683. Mirador, *Liebmann* 116. Orizaba, *Bourgeau* 2647.

10. **RYTILIX** Raf. Bull. Bot. Seringe 1: 219. 1830.

1. **Rytilix granularis** (L.) Skeels, U. S. Dept. Agric. Bur. Pl. Ind. Bull. 282: 20. 1913.

*Cenchrus granularis* L. Mant. Pl. 575. 1771.

*Manisuris granularis* Swartz, Prodr. Veg. Ind. Occ. 25. 1788.

*Hackelochloa granularis* Kuntze, Rev. Gen. Pl. 776. 1891.

Type locality "In India orientali."

RANGE: Tropical regions of both hemispheres.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San Francisquito Mountains, *Brandegge* in 1890. .

SONORA: Alamos, *Palmer* 700 in 1890.

CHIHUAHUA: Hills near Chihuahua, *Pringle* 1057.

JALISCO: Tequila, *Palmer* 366 in 1886. Guadalajara, open dry ground, side of Barranca de Oblatos, *Hitchcock* 7334. San Nicolás, sterile clay hill, *Hitchcock* 7215. Zapotlán, along railway, *Hitchcock* 7122.

COLIMA: Alzada, along railway, *Hitchcock* 7102.

GUANAJUATO: Irapuato, rocky hill, *Hitchcock* 7437.

MICHOACÁN: Uruápan, weed in old field, *Hitchcock* 6970. Sierra Madre, old cultivated fields, *Langlassé* 602.

GUERRERO: Balsas, along railroad, *Hitchcock* 6781.

MORELOS: Hills near Yautepec, *Pringle* 11228. Cuernavaca, along railway, *Hitchcock* 6870.

VERACRUZ: Orizaba, *Botteri* 1280. Consoquitla, *Liebmann* 148. Fortín, *Purpus* 2001. Córdoba, along railway, *Hitchcock* 6396.

CHIAPAS: Valley of Jiquipilas, *Nelson* 2951.

11. **TRACHYPOGON** Nees, Agrost. Bras. 341. 1829.

KEY TO THE SPECIES.

Awns plumose on the lower half only..... 1. *T. montufari*.

Awns plumose throughout; spike conspicuously feathery..... 2. *T. gouvini*.

1. **Trachypogon montufari** (H. B. K.) Nees, Agrost. Bras. 342. 1829.

*Andropogon montufari* H. B. K. Nov. Gen. & Sp. 1: 184. 1816.

Type locality, "in aridis, apricis regni Quitensis propter Conocoto, Pintae et Villam Chilloensem Montufari, Marchionis de Selvalegre."

RANGE: Texas and Arizona to Uruguay.



## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San Francisquito Mountains, *Brandeggee* in 1890.

CHIHUAHUA: Chihuahua, rocky hill, *Hitchcock* 7786; *Pringle* 495. Southwestern Chihuahua, *Palmer* 26 in 1885.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 964; *Schaffner* 1063. Las Canóas, prairie, *Hitchcock* 5768.

DURANGO: Durango, abundant in the mountains, growing in bunches, *Palmer* 383; common on the side of rough hills, *Palmer* 858a in 1896; dry ground, *Hitchcock* 7596; rocky hill, Iron Mountain, *Hitchcock* 7625. Otinapa, *Palmer* 345 in 1906.

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7344, *Palmer* 467 in 1886. Río Blanco, *Palmer* 303 in 1886. Zapotlán, hillside in pine woods, *Hitchcock* 7244.

QUERÉTARO: Between San Juan del Río and Cadereyta, *Rose, Painter & Rose* 9696.

COLIMA: Alzada, open hill, *Hitchcock* 7056.

MICHOACÁN: Morelia, *Arsène* 2535.

FEDERAL DISTRICT: Lava rock, Pedregal, *Hitchcock* 5938, 5951. Churubusco, *Orcutt* 4322.

MORELOS: Hills above Cuernavaca, *Pringle* 6514.

VERACRUZ: Mirador, *Liebmann* 88, 89, 90. Zacuapan, dry meadows, *Purpus* 1998, 2452. Orizaba, savannas, *Bourgeau* 3133, 3358; *Müller* 2085. Tierra Blanca, *Ross* 889.

GUERRERO: Balsas, prairie on high hill, *Hitchcock* 6793.

OAXACA: Las Sedas, *Conzatti* 2010, *Smith* 953.

2. *Trachypogon gouini* Fourn. Mex. Pl. 2: 66. 1886.

Type locality, "Veracruz," the type specimen collected by Gouin (no. 59).

RANGE: Veracruz and Cuba.

## HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Veracruz, low sandy prairie back of city, *Hitchcock* 6547.

12. *ELYONURUS* Humb. & Bonpl.; Willd. Sp. Pl. 4: 941. 1806.

## KEY TO THE SPECIES.

Rhizomes absent; culm hirsute below the nodes..... 1. *E. barbiculmis*.

Rhizomes present; culm glabrous.

Spikelets not hirsute on back..... 2. *E. tripsacoides*.

Spikelets hirsute on back..... 2a. *E. tripsacoides ciliaris*.

1. *Elyonurus barbiculmis* Hack. in DC. Monogr. Phan. 6: 339. 1889.

Type locality southwestern United States, "W. Texas \* \* \* New Mexico \* \* \* Arizona," being cited.

RANGE: Texas to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Rocky hills near Chihuahua, *Pringle* 423. Miñaca, on the mesa, *Hitchcock* 7745. Southwestern Chihuahua, *Palmer* 22 in 1885.

DURANGO: Durango, rocky hill, *Hitchcock* 7651; in bunches at base of hills, *Palmer* 549 in 1896. Dos Cajetes, *Palmer* 829 in 1896.

ZACATECAS: San Juan Capistrano, *Rose* 2407.

AGUASCALIENTES: Aguascalientes, along dry river, *Hitchcock* 7465.

JALISCO: Guadalajara, dry open ground along rim of Barranca de Oblatos, *Hitchcock* 7329, 7331. San Nicolás, sterile clay hill, *Hitchcock* 7218.

MORELOS: Cuernavaca, rocky hill, *Hitchcock* 6846.

PUEBLA: Laguna Chapulco, *Nicolas* in 1909.

VERACRUZ: Mirador, *Liebmann* 111.



**2. Elyonurus tripsacoides** Humb. & Bonpl.; Willd. Sp. Pl. 4: 941. 1806.

Type locality, "Caracas," Venezuela.

RANGE: Southern United States to South America.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Jalapa, prairie, *Hitchcock* 6658; *Smith* 1623½.CHIAPAS: Between San Ricardo and Ocozocuatla, *Nelson* 2990.**2a. Elyonurus tripsacoides ciliaris** (H. B. K.) Hack. in DC. Monogr. Phan. 6: 333. 1889.*Elyonurus ciliaris* H. B. K. Nov. Gen. & Sp. 1: 133. 1816.

Type locality, "in sylvis Orinocensibus prope Esmeraldam in radicibus nobilissimi montis Duidæ."

RANGE: Mexico to Venezuela.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Orizaba, grassy hill, *Hitchcock* 6360; *Bourgeau* 2844; *Botteri* 163, 669, 1264.**13. ANDROPOGON** L. Sp. Pl. 1045. 1753.

## KEY TO THE SPECIES.

Spikes solitary at the ends of the stem or branches from bract-like sheaths (spikes sometimes solitary in *A. furcatus* of group 2).

Plants annual.

Outer glumes of sterile or pediceled spikelet enlarged, thin and bract-like, imbricated and partially hiding the spikelets..... 12. *A. fastigiatus*.

Outer glumes of sterile spikelets not enlarged.

Culms weak and decumbent; blades oblong, 2 to 4 cm. long; peduncles capillary, spreading... 1. *A. brevifolius*.

Culms erect; blades linear, usually 8 to 20 cm. long; peduncles slender but not capillary, erect.

Sessile spikelet scabrous, not pilose; rachilla joint with a few hairs at summit only... 2. *A. gaumeri*.

Sessile spikelet and rachilla joint pilose..... 3. *A. malacostachyus*.

Plants perennial (sometimes flowering the first year).

Blades broad, short, firm, stiffly spreading, scattered along the wand-like culm; joints of rachis and sterile pedicels long-hairy.

Axis of spike straight and stiff; spikes more loosely scattered along the culm..... 11. *A. mexicanus*.

Axis of spike slender and flexuous; spikes aggregated toward the summit, sometimes forming a flat-topped inflorescence.

Plants without rootstocks; fertile lemma deeply 2-cleft..... 9. *A. condensatus*.

Plants with running rootstocks; fertile lemma entire or 2-toothed..... 10. *A. muelleri*.

Blades long and narrow, lax and flexuous, the culms not wand-like.

Spikes glabrous, awnless..... 8. *A. salzmanni*.



- Spikes more or less hairy, the spikelets awned.
- Sterile spikelet 2 mm. long, the pedicel very woolly. . . . . 5. *A. myosurus*.
- Sterile spikelet 4 to 6 mm. long, the pedicel hairy or ciliate but not woolly.
- Spike hairy on the entire rachis and sterile pedicels. . . . . 4. *A. feensis*.
- Spike hairy only along the edge of the sterile pedicel or at top of joints.
- Sessile spikelets 5 mm. long; sterile pedicel slightly hairy. . . . . 7. *A. tener*.
- Sessile spikelets 6 mm. long; sterile pedicel fringed with long hairs. . . . . 6. *A. cirratus*.
- Spikes more than one from each sheath (rarely solitary in *A. furcatus*).
- Spikes 2 to 4 from a bract-like leaf sheath at the ends of the stems and from the axils of the leaves, sometimes aggregated in a compound inflorescence.
- Spikes in pairs, aggregated in a dense narrow inflorescence, widened above; sheaths inclosing the base of spikes; stems tall, stiffly erect; spikes delicate, woolly with long hairs.
- Spikelets awnless; sheaths of inflorescence narrow and tightly rolled. . . . . 16. *A. bicornis*.
- Spikelets awned; sheaths of inflorescence broad, not tightly rolled. . . . . 13. *A. glomeratus*.
- Spikes 2 to 4, not aggregated in a dense inflorescence.
- Spikes somewhat hairy but not conspicuously woolly, the axis stout. . . . . 20. *A. furcatus*.
- Spikes conspicuously woolly or silky with long white or tawny hairs.
- Axis of spike straight and rather stout; spikes 2, exserted from the slender sheath; sessile spikelets awned; pediceled spikelet well developed. . . . . 21. *A. hirtus*.
- Axis of spike slender, often flexuous.
- Spikelets awnless.
- Spikes 5 to 8 cm. long, usually inclosed at base; spikelets large; sterile pedicel 6 mm. long; culms about 60 cm. high. . . . . 18. *A. bourgaei*.
- Spikes about 2.5 cm. long, the group long-exserted on a slender peduncle; spikelets small, these and the sterile pedicel less than 3 mm. long; culms 65 to 100 cm. high. . . . . 17. *A. leucostachyus*.
- Spikelets awned.
- Hairs of the rachis and sterile pedicels scarcely half as long as the spikelets; axis nearly straight. . . . . 19. *A. pringlei*.
- Hairs of the rachis and sterile pedicels longer than the spikelets; axis flexuous.



- Culms about 1.5 meters high;  
spikes inclosed at base by  
the sheath; clusters of  
spikes scattered along the  
upper part of the culm.... 14. *A. virginicus*.
- Culms about 60 cm. high; cluster  
of spikes long-exserted at  
the end of the culm..... 15. *A. liebmanni*.
- Spikes several or many (sometimes only two in *A. piptatherus*), aggregated on a short or elongated axis,  
raised on a naked peduncle at the summit of the  
culm.
- Plants annual; culms weak and straggling..... 28. *A. piptatherus*.
- Plants perennial; culms erect or nearly so.
- Spikes few, not woolly, short-peduncled, loosely  
spreading ..... 23. *A. hirtifolius*.
- Spikes usually numerous, woolly with long white  
or tawny hairs.
- Outer glume not pitted.
- Nodes bearded; plant stout..... 25. *A. barbinodis*.
- Nodes glabrous; plant more delicate..... 24. *A. saccharoides*.
- Outer glume of sessile spikelet with a pinhole-  
like pit about the middle.
- Spikes few, stiffly erect..... 22. *A. wrightii*.
- Spikes numerous, more loosely ascending.
- Spikes approximate, forming a flabel-  
late cluster..... 26. *A. perforatus*.
- Spikes in a dense oblong panicle, 15  
to 20 cm. long ..... 27. *A. altus*.
- 1. *Andropogon brevifolius* Swartz, Prodr. Veg. Ind. Occ. 26, 1788.**  
Type locality, "Jamaica."  
RANGE: Tropical regions of both hemispheres.  
HERBARIUM SPECIMENS FROM MEXICO:  
SINALOA: Cerro Colorado, *Brandegge* in 1904.  
JALISCO: Guadalajara, moist fields, *Pringle* 1771; Río Blanco, *Palmer* 593 in 1886;  
San Nicolás, sterile clay hill, *Hitchcock* 7217.  
COLIMA: Alzada, *Orcutt* 4681.  
MORELOS: Hills near Yautepec, *Pringle* 11210.
- 2. *Andropogon gaumeri* (Nash).**  
*Schizachyrium gaumeri* Nash, N. Amer. Fl. 17: 102. 1912.  
Type locality, "Izamal, Yucatan," the type specimen collected by Gaumer (no. 1037).  
RANGE: Known only from the type collection.
- 3. *Andropogon malacostachyus* Presl, Rel. Haenk. 1: 337. 1830.**  
Type locality, "Acapulco."  
RANGE: Southern Mexico and Central America.  
HERBARIUM SPECIMENS FROM MEXICO:  
JALISCO: Guadalajara, dry gravelly soil, *Pringle* 4514.  
PUEBLA: Puebla, *Nicolas* in 1909.  
GUERRERO: Balsas, along railroad, *Hitchcock* 6806.  
YUCATÁN: Tekax, *Gaumer* 1134.



**4. *Andropogon feensis*** Fourn. Mex. Pl. 2: 62. 1886.*Andropogon hirtiflorus feensis* Hack. in DC. Monogr. Phan. 6: 372. 1889.

Type locality, "Barranca prope Santa Fe in valle Mexicensi," the type specimen collected by Bourgeau (no. 752).

RANGE: Arizona to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San Francisquito Mountains, *Brandeggee* in 1890. El Taste, *Brandeggee* in 1893. Sierra de Laguna, *Brandeggee* in 1890.SONORA: Fronteras, *Hartman* 11.CHIHUAHUA: Chihuahua, rocky hill, *Hitchcock* 7790, *Pringle* 383. Miñaca, rocky hill, *Hitchcock* 7743. Sierra Madre near Colonia García, in rocks, *Townsend & Barber* 335 (the type collection of *Schizachyrium semiglabrum* Nash,<sup>1</sup> with rachis, internodes, and pedicels glabrous on the back, and ciliate on the margins as in typical *A. feensis*).DURANGO: Durango, rocky hill, *Hitchcock* 7589.SAN LUIS POTOSÍ: San Luis Potosí, prairie, *Hitchcock* 5690; *Parry & Palmer* 966; *Schaffner* 153. Cárdenas, railway cut, *Hitchcock* 5775.JALISCO: Guadalajara, prairie, *Hitchcock* 7271. San Nicolás, sterile hill, *Hitchcock* 7232. Zapotlán, prairie, *Hitchcock* 7144.FEDERAL DISTRICT: Lava rock in pedregal, *Hitchcock* 5936, 5938½; *Holway* 3063.MÉXICO: Popo Park, edge of woods, *Hitchcock* 6018.MICHOACÁN: Morelia, Lomas de la Huerta, *Arsène* 2634.PUEBLA: Cholula, *Nicolas* in 1910.MORELOS: Cuernavaca, rocky hill, *Hitchcock* 6845.VERACRUZ: Orizaba, rocky hill, *Hitchcock* 6354, 6361. Alta Luz, *Purpus* 5069. Zacuapan, Barranca de Tenampa, *Purpus* 6208.OAXACA: Oaxaca, rocky hill, *Hitchcock* 6132.**5. *Andropogon myosurus*** Presl, Rel. Haenk. 1: 337. 1830.

Type locality, "Mexico."

RANGE: Only known from the type and the following.

## HERBARIUM SPECIMEN:

JALISCO: Guadalajara, *Palmer* 506 in 1886.**6. *Andropogon cirratus*** Hack. Flora 68: 119. 1885.

Type locality, "America borealis: Inter civitatem Texas orient. et El Paso in civit. Neo-Mexicana," the type specimen collected by Wright, his numbers 804 and 2105 cited.

RANGE: Southwestern United States and northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Rocky hills near Chihuahua, *Pringle* 382. Miñaca, rocky hill, *Hitchcock* 7744. Sánchez, rocky pine woods, *Hitchcock* 7672. Southwest Chihuahua, *Palmer* 7 in 1885.DURANGO: Durango, rocky hill, *Hitchcock* 7650.**7. *Andropogon tener*** (Nees) Kunth, Rèv. Gram. 2: 565. 1832.*Schizachyrium tenerum* Nees, Agrost. Bras. 336. 1829.

Type locality, "Monte Video. \* \* \* in confinibus Regni Paraguayani in provincia Rio grande do Sul dictu," the type specimen collected by Sello.

RANGE: Southern United States to Argentina.

## HERBARIUM SPECIMENS FROM MEXICO:

DURANGO: Durango, sides of rough hills, *Palmer* 858 in 1896.SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 965.<sup>1</sup> N. Amer. Fl. 17: 103. 1912.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

JALISCO: Guadalajara, prairie, *Hitchcock* 7272; *Palmer* 504 in 1886; dry banks, *Pringle* 11733. Zapotlán, hills, *Hitchcock* 7171.

MICHOACÁN: Uruápan, prairie, *Hitchcock* 6971. Morelia, *Arsène* in 1909.

VERACRUZ: Orizaba, open rocky hill, *Hitchcock* 6381; *Botteri* 671; *Bourgeau* 3134.

CHIAPAS: Tuxtla, *Nelson* 3108.

8. *Andropogon salzmanni* (Trin.).

*Rottboellia salzmanni* Trin. in Steud. Syn. Pl. Glum. 1: 361. 1854.

*Andropogon imberbis muticus* Hack. in DC. Monogr. Phan. 6: 380. 1889.

Type locality, "Bahia," Brazil, the type specimen collected by Salzmann.

RANGE: Mexico and the West Indies to Argentina.

## HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Mirador, *Liebmann* 115.

9. *Andropogon condensatus* H. B. K. Nov. Gen. & Sp. 1: 188. 1816.

Type locality, "in temperatis, apricis Regni Novo granatensis prope Ibague et Valle de Caravajal, ad radices montis Quindiu."

RANGE: Eastern Mexico to Argentina.

## HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Tamasopo Canyon, ledges and gravelly slides, *Pringle* 3134.

VERACRUZ: Mirador, *Liebmann* 50, 52, 54. Jalapa, prairie, *Hitchcock* 6626, 6661, 6669. Córdoba, clay cut, *Hitchcock* 6412. Orizaba, *Botteri*, *Bourgeau* 2646; open rocky hill, *Hitchcock* 6373.

10. *Andropogon muelleri* (Nash).

*Schizachyrium muelleri* Nash, N. Amer. Fl. 17: 106. 1912.

Type locality, "Vera Cruz, Mexico," the type specimen collected by Müller (no. 2176).

RANGE: Known only from Veracruz.

## HERBARIUM SPECIMENS:

VERACRUZ: Veracruz, low prairie, *Hitchcock* 6548; *Müller* 2176. Jalapa, prairie, *Hitchcock* 6659.

11. *Andropogon mexicanus* sp. nov.

Perennial; culms erect and wand-like or sometimes decumbent and rhizomatous at base, 1 to few in a cluster, glabrous, flattened, about 1 meter high; sheaths glabrous, strongly compressed-keeled; ligule rather firm, 1 mm. long; blades firm, stiffly spreading, rounded at base, abruptly apiculate, glabrous except on the margins and midrib beneath, flat or, especially on the innovations, folded, 5 to 15 cm. long, as much as 1 cm. wide; racemes (spikes) solitary from each subtending sheath, 1 to 2 cm. long, more or less fascicled or clustered along the upper part of the culm; subtending sheaths 2 to 2.5 cm. long, scarcely inflated, inclosing the villous peduncle and the base of the spike; joints of the rachis about 7 mm. long, long-villous on the margins, the cup at apex scarcely oblique; sessile spikelet about as long as the rachis joint, not villous, scabrous on the keels, the awn geniculate, loosely twisted below, exerted about 1 cm.; pediceled spikelet reduced to an awned glume, the pedicel a little shorter than the joint, long-villous with ascending hairs.

Type in the U. S. National Herbarium, no. 155148, collected on "Cool slopes of the barranca near Guadalajara," Jalisco, Mexico, November 19, 1888, by C. G. Pringle (no. 1805).

RANGE: Tepic and Jalisco.

## HERBARIUM SPECIMENS:

TEPIC: Common on grassy plains and hillsides, *Palmer* 1922 in 1892.

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7341, *Pringle* 1805.

12. *Andropogon fastigiatus* Swartz, Prodr. Veg. Ind. Occ. 26. 1788.

Type locality, "Jamaica."



RANGE: Mexico and West Indies to Brazil.

HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, rocky hills, *Pringle* 2320. Río Blanco, *Palmer* 507 and 588 in 1886. San Nicolás, sterile clay hill, *Hitchcock* 7211.

MORELOS: Yautepec, limestone hills, *Pringle* 11211.

13. *Andropogon glomeratus* (Walt.) B. S. P. Prel. Cat. N. Y. 67. 1888.

*Cinna glomerata* Walt. Fl. Carol. 59. 1788.

*Andropogon macrourum* Michx. Fl. Bor. Amer. 1: 56. 1803.

Type locality, South Carolina.

RANGE: Eastern United States to the West Indies and Central America.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Canyon Cantillas, *Orcutt* 1144. West side of mountains, Caperegion, *Brandegge* in 1902. Sierra de San Francisquito, *Brandegge* in 1892.

DURANGO: Durango, edge of spring, *Palmer* 251 in 1896.

JALISCO: Guadalajara, along stream in Barranca de Oblatos, *Hitchcock* 7354. Río Blanco, *Palmer* 466 in 1886.

PUEBLA: Mount Orizaba, *Seaton* 111. Puebla, *Nicolas* in 1909.

VERACRUZ: Jalapa, clay cut, *Hitchcock* 6589; ditch along railway, *Hitchcock* 6671.

Mirador, *Liebmann* 61. Veracruz, along ditch, *Hitchcock* 6585. Córdoba, *Fink* 9; clay bank, *Hitchcock* 6419. Orizaba, open rocky hill, *Hitchcock* 6366, 6376; roadside ditch, *Hitchcock* 6342.

OAXACA: San Antonio Valley, *Smith* 960.

14. *Andropogon virginicus* L. Sp. Pl. 1046. 1753.

Type locality "in America," probably in Virginia.

RANGE: Eastern United States, West Indies, and eastern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Jalapa, prairie, *Hitchcock* 6660, 6670.

15. *Andropogon liebmanni* Hack. Flora 68: 132. 1885.

Type locality, "Mexico: prope Chinantla in campis," the type specimen collected by *Liebmann* (no. 590).

RANGE: Southern Mexico.

HERBARIUM SPECIMENS:

TEPIC: Sierra Madre near Santa Teresa, *Rose* 2222.

JALISCO: Guadalajara, gravelly banks, *Pringle* 11212, *Palmer* 227 in 1886.

MICHOACÁN: Uruápan, low prairie, *Hitchcock* 6995.

PUEBLA: Chinantla, *Liebmann* 77.

VERACRUZ: Orizaba, *Bourgeau* 2376.

16. *Andropogon bicornis* L. Sp. Pl. 1046. 1753.

Type locality given as "Brasilia, Jamaica."

RANGE: West Indies and southern Mexico to Brazil.

HERBARIUM SPECIMENS FROM MEXICO:

PUEBLA: On the Atoyac River, *Nicolas* in 1910.

VERACRUZ: La Luz near Córdoba, swamp, *Kerber* 92. Orizaba, *Botteri* 668.

Mirador, *Liebmann* 60.

OAXACA: Tacotepec, *Hartweg* 521.

TABASCO: Los Cacaos, plains, *Rovirosa* 606.

17. *Andropogon leucostachyus* H. B. K. Nov. Gen. & Sp. 1: 187. 1816.

Type locality, "in ripa rivulorum qui vallem percurrunt Caripensem Curnanensium."

RANGE: West Indies and southern Mexico to Brazil.



## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Zacuapan, dry ground, *Purpus* 2449. Mirador, *Sartorius*.

**18. *Andropogon bourgaei* Hack. Flora 68: 134. 1885.**

Type locality, "Mexico: Orizaba," the type specimen collected by Bourgeau (no. 2645).

RANGE: Known only from the State of Veracruz.

## HERBARIUM SPECIMENS:

VERACRUZ: Río Blanco near Orizaba, *Bourgeau* 2645. Mirador, *Liebmann* 76.

**19. *Andropogon pringlei* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 7. 1901.**

Type locality, "Valley of Mexico, Federal District," the type specimen collected by Pringle (no. 6577).

RANGE: Known only from the Federal District.

HERBARIUM SPECIMENS: Federal District, Eslava, dry soil, *Pringle* 6577, 9561.

**20. *Andropogon furcatus* Muhl.; Willd. Sp. Pl. 4: 919. 1806.**

*Andropogon provincialis* Lam. Encycl. 1: 376. 1783, not Retz. 1783.

BIG BLUESTEM.

Type locality, "in America boreali."

RANGE: Throughout eastern United States and south to southern Mexico; in the Old World known only from the coast of Provence, France.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Zapotlán, hills, *Hitchcock* 7174.

MICHOACÁN: Morelia, *Arsène* in 1909.

MÉXICO: Toluca, prairie, *Pringle* 4294.

PUEBLA: San Simón, *Purpus* 4216.

**21. *Andropogon hirtus* L. Sp. Pl. 1046. 1753.**

Type locality, southern Europe, "in Lusitania, Sicilia, Smyrnae."

RANGE: Mediterranean region; sparingly introduced in Mexico and the West Indies.

## HERBARIUM SPECIMEN FROM MEXICO:

NUEVO LEÓN: Monterey, river bluffs, *Pringle* 1967.

**22. *Andropogon wrightii* Hack. Flora 68: 139. 1885.**

Type locality, "America septentrionalis: New Mexico," the type specimen collected by Wright (no. 2104).

RANGE: New Mexico and northern Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

CHIHUAHUA: Mesas near Cusiuhiriáchic, *Pringle* 1409.

**23. *Andropogon hirtifolius* Presl, Rel. Haenk. 1: 338. 1830.**

Type locality, "Mexico."

RANGE: Southern Mexico.

## HERBARIUM SPECIMENS:

JALISCO: Guadalajara, hillsides, *Pringle* 3032. San Nicolás, prairie, *Hitchcock* 7198. Zapotlán, hills, *Hitchcock* 7175. Chapala, *Rose* 3438, *Rose & Painter* 7639.

MICHOACÁN: Pátzcuaro, *Holway* 3216. Morelia, *Arsène* in 1909.

PUEBLA: Hacienda Noria, *Nicolas* in 1910.

MORELOS: Yautepec, lava fields, *Pringle* 8702.

OAXACA: Las Sedas, calcareous hills, *Pringle* 4781. Mountain ridge on west side of valley of Cuicatlán, *Nelson* 1903, 1904. Oaxaca, *Rose* 3652.

**24. *Andropogon saccharoides* Swartz, Prodr. Veg. Ind. Occ. 26. 1788.**

Type locality, "Jamaica."

RANGE: Southwestern United States to Argentina.



## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Cananea, *Griffiths* 4867.

CHIHUAHUA: Paso del Norte, *Pringle* 1994.

DURANGO: Durango, edge of spring, *Palmer* in 1896.

COAHUILA: Saltillo, sandy field, *Hitchcock* 5623; moist places, *Palmer* 1347 in 1880, 4, 261, and 810 in 1898.

NUEVO LEÓN: Monterey, Sierra Madre, *Pringle* 1971; edge of field, *Hitchcock* 5544.

SAN LUIS POTOSÍ: San Luis Potosí, prairie, *Hitchcock* 5716.

JALISCO: Zapotlán, prairie, *Hitchcock* 7143.

GUANAJUATO: Irapuato, moist sandy clay soil *Hitchcock* 7396. Acámbaro, prairie, *Hitchcock* 6931.

QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5834.

MÉXICO: Valley of Mexico, *Pringle* 9588. Federal District, prairie, *Hitchcock* 5896; *Pringle* 8660; *Rose* 3571.

PUEBLA: Pont del México, *Nicolas* in 1909.

MORELOS: Cuernavaca, low place in prairie, *Hitchcock* 6873; barranca, *Rose, Painter & Rose* 10194.

VERACRUZ: Jalapa, clay cut, *Hitchcock* 6595; *Smith* 1623. Mirador, *Liebmann* 82. Fortín, *Purpus* 1995. Orizaba, rocky hill, *Hitchcock* 6359; roadside ditch, *Hitchcock* 6334; *Botteri* 667; *Bourgeau* 2969.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6134; prairie, *Hitchcock* 6167. Cañada de San Gabriel, *Conzatti & González* 320.

**25. *Andropogon barbinodis* Lag. Gen. & Sp. Nov. 3. 1816.**

Type locality, "H. in N. H. [Habitat in Nova Hispania] \* \* \* Semina communicavit D. Sessé."

RANGE: Southwestern United States to Argentina.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Caysito, *Orcutt* 514.

SONORA: Guaymas, cliffs of seashore, *Hitchcock* 3563. Nogales, prairie, *Hitchcock* 3629.

CHIHUAHUA: Chihuahua, rocky hill, *Hitchcock* 7798. Miñaca, dry rocky run, *Hitchcock* 7737. Southwestern Chihuahua, *Palmer* 2, 2a in 1885. Casas Grandes, *Nelson* 6342.

COAHUILA: Saltillo, dry ground, river bottom, *Hitchcock* 5637.

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5529.

DURANGO: Durango, prairie, *Hitchcock* 7585; hills and grassy plains, *Palmer* 538 in 1896.

ZACATECAS: Concepción del Oro, *Palmer* 262 in 1904. Plateado, *Rose* 2758.

AGUASCALIENTES: Aguascalientes, edge of field, *Hitchcock* 7449.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 158. Cárdenas, along irrigation ditch, *Hitchcock* 5747. Minas de San Rafael, *Purpus* 5436.

JALISCO: Guadalajara, prairie, *Hitchcock* 7269.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7408.

HIDALGO: Pachuca, sandy river bed, *Hitchcock* 6766. Sierra de la Mesa, *Rose, Painter & Rose* 9098. Tula, *Rose, Painter & Rose* 8360.

FEDERAL DISTRICT: *Orcutt* 3687.

**26. *Andropogon perforatus* Trin.; Fourn. Mex. Pl. 2: 59. 1886.**

*Andropogon saccharoides* Swartz, subsp. *leucopogon* var. *perforatus* Hack. in DC. Monogr. Phan. 6: 496. 1889.

Type locality, "envir[ons] de Mexique," according to the label on the type specimen collected by Berlandier (no. 641) in the Trinius Herbarium.



RANGE: Southwestern United States and Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Sierra Madre near Monterey, *Pringle* 1971.

DURANGO: Durango, prairie along creek, *Hitchcock* 7613;<sup>1</sup> damp place along river, *Palmer* 469 in 1896.

SAN LUIS POTOSÍ: San Luis Potosí, edge of field, *Hitchcock* 5681.

ZACATECAS: Zacatecas, gulch in dry hill, *Hitchcock* 7507; hills, *Pringle* 1761.

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7360.<sup>1</sup> Río Blanco, *Palmer* 305 in 1886.<sup>1</sup> San Nicolás, prairie, *Hitchcock* 7195. Zapotlán, prairie, *Hitchcock* 7126.

GUANAJUATO: Acámbaro, prairie, *Hitchcock* 6951.

QUERÉTARO: Querétaro, rocky hill, *Hitchcock* 5842.

MICHOACÁN: Morelia, hills, *Arsène* in 1909.

HIDALGO: Pachuca, rocky slopes, *Purpus* 1631.

MORELOS: Cuernavaca, prairie, *Hitchcock* 6869.

VERACRUZ: Orizaba, *Bourgeau* 2374.

**27. *Andropogon altus* sp. nov.**

Culms in small clumps, erect or slightly decumbent at base, about 1.5 meters high, rather slender, the nodes bearded with stiff ascending hairs, the internodes glabrous; sheaths glabrous; ligules membranaceous, 3 to 4 mm. long; blades flat, scabrous, bearing a few long hairs on the upper surface near the base, 20 to 30 cm. long, 5 to 10 mm. wide, narrowed into a fine point, the uppermost smaller; panicle long-exserted, oblong, dense, 15 to 20 cm. long, the branches appressed, naked below, these and the primary axis glabrous; racemes 2 to 3 cm. long, clustered on the upper part of the branches, the rachis joints about 4 mm. long, deeply channeled, densely long-villous with ascending hairs 5 to 8 mm. long; sessile spikelet 5 mm. long, villous at base, scabrous toward the apex, otherwise glabrous, a well-marked pinhole-like pit in the depression on the back somewhat above the middle; awn geniculate, about 2 cm. long, tightly twisted below, loosely twisted above; sterile spikelet reduced to a nerved awnless scale 3 to 4 mm. long, the pedicel somewhat longer than the rachis joint and similarly villous.

Type in the U. S. National Herbarium, no. 691232, collected "along irrigation ditch, Querétaro," State of Querétaro, Mexico, July 25, 1910, by A. S. Hitchcock (no. 5868).

*Andropogon altus* differs from *A. perforatus* in the elongated panicle and shorter racemes clustered toward the ends of the branches. The species has the aspect of *Erianthus*.

RANGE: Highlands of central Mexico.

HERBARIUM SPECIMENS:

SAN LUIS POTOSÍ: Las Canoas, moist grassy ground, *Hitchcock* 5759.

JALISCO: Guadalajara, dry open ground along rim of Barranca de Oblatos, *Hitchcock* 7327; side of Barranca de Oblatos, *Hitchcock* 7359.

QUERÉTARO: Querétaro, along irrigation ditch, *Hitchcock* 5868.

**28. *Andropogon piptatherus* Hack. in Mart. Fl. Bras. 2<sup>3</sup>: 293. 1883.**

Type locality, "in prov. Goyaz ad Porto Imperial et Funil," the type specimen collected by Burchell, nos. "8761-7 et 8780" cited.

RANGE: Mexico to Brazil.

HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Lodiogo, hillside in shade, *Palmer* 1654 in 1891. Copradía, *Brandeggee* in 1904.

<sup>1</sup> The blades and upper part of sheaths densely villous; referable to *A. saccharoides* subsp. *leucopogon* var. *palmeri* Hack. (in DC. Monogr. Phan. 6: 496. 1889.), *Amphiplophus palmeri* Nash (Fl. N. Amer. 17: 126. 1912.), *Palmer* 305 being the type collection. This may be worthy of subspecific or specific rank.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

JALISCO: Río Blanco, *Palmer* 591 in 1886. Guadalajara, in shade near base of Barranca de Oblatos, *Hitchcock* 7367. Tequila, dry slopes of barranca, *Pringle* 4612.

COLIMA: Alzada, among bushes on rocky hill, *Hitchcock* 7109.

## 14. CYMBOPOGON Spreng. Pl. Pugill. 2: 14. 1815.

## KEY TO THE SPECIES.

- Awn 2.5 cm. long..... 1. *C. bracteatus*.  
Awn 5 to 7.5 cm. long..... 2. *C. ruprechtii*.

1. *Cymbopogon bracteatus* (Willd.).

*Andropogon bracteatus* Willd. Sp. Pl. 4: 914. 1806.

Type locality, "Cumana," Venezuela.

RANGE: Mexico to Brazil.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Mirador, *Liebmann* 46, *Ross* 630. Zacuapan, *Purpus* 1996.

CHIAPAS: Yajalón, *Nelson* 3399.

2. *Cymbopogon ruprechtii* (Hack.).

*Andropogon ruprechtii* Hack. in DC. Monogr. Phan. 6: 645. 1889.

Type locality, Zacuapan, Veracruz, the type specimen collected by Galeotti (no. 5697). The first description is by Hackel (loc. cit.), but the Galeotti specimen was mentioned earlier by Ruprecht in his list of Galeotti's plants (Bull. Acad. Sci. Brux. 9: 245. 1842). This specimen among others was cited by Hackel and is the type as it suggested the specific name.

RANGE: Mexico to Central America.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7339. Río Blanco, *Palmer* 513 in 1886. Sierra Madre west of Bolaños, *Rose* 2956.

COLIMA: Alzada, prairie, *Hitchcock* 7066.

MICHOACÁN: El Ocote, rocky hill, *Langlassé* 530.

CHIAPAS: Roadside between San Ricardo and Ocozocuahtla, *Nelson* 2991.

## 15. HOLCUS L. Sp. Pl. 1047. 1753.

## SORGHUM.

## KEY TO THE SPECIES.

- Spikelets and pedicels densely clothed with golden brown hairs;  
panicle branches capillary..... 2. *H. trichocladius*.  
Spikelets and pedicels sparsely clothed with pale hairs; panicle  
branches not capillary..... 1. *H. halepensis*.

1. *Holcus halepensis* L. Sp. Pl. 1047. 1753.

JOHNSON GRASS.

*Andropogon halepensis* Brot. Fl. Lusit. 1: 89. 1804.

Type locality given as "in Syria, Mauritania."

RANGE: Widely distributed in the warmer parts of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Hermosillo, weed in field, *Hitchcock* 3614. Guaymas, *Palmer* 64 in 1887, 687 in 1890. Magdalena, *Rose*, *Standley & Russell* 15096. Alamos, *Rose*, *Standley & Russell* 13027.

SINALOA: Culiacán, *Palmer* 1559 in 1891. Rosario, *Lamb* 478.

DURANGO: Durango, weed in field, *Hitchcock* 7562, 7660.

COAHUILA: Saltillo, weed in field, *Hitchcock* 5649.

NUEVO LEÓN: Monterey, sandy field, *Hitchcock* 5553.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

TAMAULIPAS: Victoria, *Palmer* 553 in 1907.SAN LUIS POTOSÍ: San Luis Potosí, irrigated field, *Hitchcock* 5693.TEPIC: Tepic, *Palmer* 1917 in 1892.JALISCO: Guadalajara, along stream, *Hitchcock* 7350HIDALGO: Tula, *Rose, Painter & Rose* 8355.COLIMA: Alzada, along railroad, *Hitchcock* 7095. Paso del Río, *Emrick*, 200.MICHOACÁN: Morelia, *Arsène* in 1909.GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7394.FEDERAL DISTRICT: Tacubaya, *Hitchcock* 5910.VERACRUZ: Veracruz, weed along street, *Hitchcock* 6574. Orizaba, roadside ditch, *Hitchcock* 6317, *Holway* 3077.**2. *Holcus trichocladus* (Rupr.) Nash, N. Amer. Fl. 17: 131. 1912.***Andropogon trichocladus* Rupr.; Hack. in DC. Monogr. Phan. 6: 525. 1889.

Type locality, "Mexico: in montosis graminosis inter la Galera et Pochutla prope Talca in Prov. Oajaca (Liebmann, 23, 24 in h. Havn.): loco non indicato l. Karwinsky (in h. Vindob. ubi a cl. Rupr. denominatus)."

RANGE: Southern Mexico.

## HERBARIUM SPECIMENS:

TEPIC: Tepic, *Palmer* 2030a in 1892.OAXACA: Mina de Dolores, *Liebmann* 24.**16. *Sorghastrum* Nash in Britton, Man. 71. 1901.**

## KEY TO THE SPECIES.

## Plants annual.

Spikelets pale, 4 mm. long; plants mostly less than 0.5 meter high..... 1. *S. incompletum*.Spikelets dark brown, 5 mm. long; plants mostly more than 1 meter high..... 2. *S. liebmännianum*.

## Plants perennial.

Awn poorly developed, the exserted portion usually less than 5 mm. long, with one bend, sometimes short and straight..... 3. *S. agrostoides*.

Awn well developed, the exserted portion 10 to 15 mm. long, bent twice.

Blades, especially the lower and those of the innovations, short and straight, 3 to 10 cm. long; panicle loose, few-flowered, the pedicels capillary and recurved-flexuous..... 4. *S. nudipes*.Blades elongated; panicle rather dense, many-flowered; pedicels straight or somewhat recurved..... 5. *S. nutans*.**1. *Sorghastrum incompletum* (Presl) Nash, N. Amer. Fl. 17: 130. 1912.***Andropogon incompletus* Presl, Rel. Haenk. 1: 342. 1830.*Andropogon nutans incompletus* Hack. in DC. Monogr. Phan. 6: 531. 1889.

Type locality, "Mexico."

RANGE: Southern Mexico to Costa Rica.

## HERBARIUM SPECIMENS FROM MEXICO:

COLIMA: Alzada, *Orcutt* 4632; Tuxpán Canyon, *Orcutt* 4707.JALISCO: Guadalajara, hillside, *Pringle* 2466. Open dry ground along side of Barranca de Oblatos, *Hitchcock* 7330. Río Blanco, *Palmer* 590 in 1886.MICHOACÁN: El Ocote, rocky hill, *Langlassé* 533.OAXACA: Huatulco, *Liebmann* 34.



**2. *Sorghastrum liebmannianum* sp. nov.**

Annual; culms slender, erect, 1.5 to 2 meters high, glabrous, the nodes glabrous or appressed-pubescent; sheaths scabrous or somewhat hirsute, the ligule 3 to 6 mm. long, indurated at the edges; blades 15 to 30 cm. long, 3 to 7 mm. wide, flat, scabrous; panicle narrow, rather loose, 15 to 25 cm. long; pedicels slender, appressed-villous with a few long hairs toward the summit, the apex abruptly enlarged; sessile spikelet 4 to 5 mm. long, dark brown, more or less appressed-hirsute to apex; awn well developed, 10 to 15 mm. long, with two more or less distinct bends; sterile pedicels a little shorter than the sessile spikelet, plumose with purplish hairs.

Type in the U. S. National Herbarium, no. 691222, collected on an open rocky hill, Orizaba, Veracruz, Mexico, August 24, 1910, by A. S. Hitchcock (no. 6352).

Other specimens in the National Herbarium, all from Veracruz, are: Totutla, *Liebmann* 25; Orizaba, *Botteri* 642, 646.

This species is included by Hackel<sup>1</sup> with *Andropogon nutans linneanus* Hack., the type of which comes from the southeastern United States. The latter differs in its perennial habit, larger spikelets, and longer awns and blades.

**3. *Sorghastrum agrostoides* (Speg.).**

*Andropogon agrostoides* Speg. Anal. Soc. Cienc. Argentina **16**: 136. 1883.

*Andropogon nutans agrostoides* Hack. in DC. Monogr. Phan. **6**: 529. 1889.

Type locality, "In pratis uliginosis praecipue ad limina sylvarum in 'Chaco.' Prope coloniam 'Resistencia.' "

RANGE: Southern Mexico to Argentina.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Consoquitla, *Liebmann* 37. Jalapa, large bunches, sometimes with short rhizomes, prairie, *Hitchcock* 6692. Mirador, *Liebmann* 36. Orizaba, *Botteri*.

CHIAPAS: Ricardo, *Nelson* 2967. Ocuilapa, *Nelson* 3008.

**4. *Sorghastrum nudipes* Nash, N. Amer. Fl. **17**: 129. 1912.**

Type locality, "pine plains, base of the Sierra Madre, Chihuahua, Mexico," the type specimen collected by Pringle (no. 1433).

RANGE: Known only from Chihuahua.

HERBARIUM SPECIMENS:

CHIHUAHUA: Sánchez, rocky pine woods, *Hitchcock* 7678. Sierra Madre, pine plains, *Pringle* 1433. Near Colonia García, *Townsend & Barber* 336. Southwestern Chihuahua, *Palmer* 11 in 1885.

**5. *Sorghastrum nutans* (L.) Nash in Small, Fl. Southeast. U. S. **66**. 1903.**

*Andropogon nutans* L. Sp. Pl. 1045. 1753.

Type locality, "Virginia, Jamaica." The type specimen in the Linnæan Herbarium was collected by Kalm, and consequently came from somewhere in Canada or the northeastern United States and was not from Virginia or Jamaica. The latter localities refer to synonyms cited by Linnæus, both of which refer to other species.<sup>2</sup>

RANGE: Eastern United States to Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Socorro Island, *Anthony* 401.

SONORA: Cochuto, *Hartman* 88.

JALISCO: Guadalajara, in bunches, side of Barranca de Oblatos, *Hitchcock* 7346.

Río Blanco, *Palmer* 511 in 1886.

MICHOACÁN: Morelia, *Nicolas* in 1909.

VERACRUZ: Alta Luz, rocky soil, *Purpus* 2897, 5592.

OAXACA: Mountain ridge on west side of valley of Cuicatlán, *Nelson* 1905a; Reyes, *Nelson* 1807a. Las Sedas, *Smith* 917.

<sup>1</sup> DC. Monogr. Phan. **6**: 531. 1889.

<sup>2</sup> Hitchcock, Contr. U. S. Nat. Herb. **12**: 125. 1908.



17. **HETEROPOGON** Pers. Syn. Pl. 2: 533. 1807.

## KEY TO THE SPECIES.

- Plants perennial, 60 to 100 cm. high; outer glume of staminate spikelets pilose..... 1. *H. contortus*.  
 Plants annual, 1.3 to 2.4 meters high; outer glume of staminate spikelets beset with a row of glands along the back, not pilose..... 2. *H. melanocarpus*.

1. **Heteropogon contortus** (L.) Beauv.; Roem. & Schult. Syst. Veg. 2: 836. 1817.  
*Andropogon contortus* L. Sp. Pl. 1045. 1753.

Type locality, "India."

RANGE: Warmer parts of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San Pablo, rocky cliffs, *Purpus* 230. San José del Cabo, *Brandege* 35.

SONORA: Llano, prairie, *Hitchcock* 3524. Guaymas, *Palmer* 267 in 1887. Alamos, *Rose, Standley & Russell* 12713. Papago Tanks, *MacDougal* 52.

CHIHUAHUA: Chihuahua, rocky hill, *Hitchcock* 7800; *Pringle* 480. Santa Eulalia Plains, *Wilkinson* in 1885. Southwestern Chihuahua, *Palmer* 115b.

DURANGO: Durango, Iron Mountain, rocky hill, *Hitchcock* 7641; *Palmer* 540 in 1896.

COAHUILA: Monclova, *Palmer* 1346 in 1880.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 154, 169; *Parry & Palmer* 955. Las Canoas, prairie, *Hitchcock* 5762.

AGUASCALIENTES: Aguascalientes, *Hartweg* 249; prairie, *Hitchcock* 7484.

JALISCO: Guadalajara, *Palmer* 767 and 767a in 1886; dry open ground, rim of Barranca de Oblatos, *Hitchcock* 7325; *Rose* 3428. Balaños, *Rose* 2938. San Nicolás, sterile clay hill, *Hitchcock* 7212.

QUERÉTARO: San Juan del Río, stony hillside, *Rose, Painter & Rose* 9560.

COLIMA: Alzada, prairie, *Hitchcock* 7058.

MICHOACÁN: Chapala, *Rose* 3445. Morelia, *Arsène* in 1909.

VERACRUZ: Orizaba, open rocky hill, *Hitchcock* 6375; *Bourgeau* 2374.

PUEBLA: Tehuacán, sterile hill, *Hitchcock* 6092.

MORELOS: Cuernavaca, prairie, *Hitchcock* 6871.

GUERRERO: Balsas, prairie, *Hitchcock* 6779.

OAXACA: Tomellín, rocky hill, *Hitchcock* 6193. Santa Catarina Canyon, *Pringle & Conzatti* 281. Huitzo, *Conzatti* 2011. Oaxaca, rocky hill, *Hitchcock* 6102, 6158; *Nelson* 1367a, 1440.

2. **Heteropogon melanocarpus** (Ell.) Benth. Journ. Linn. Soc. Bot. 14: 71. 1882 (where it is erroneously credited to Elliott).

*Andropogon melanocarpus* Ell. Bot. S. C. & Ga. 1: 146. 1816.

Type locality, "in the pine barrens between Fort Barrington on the Altamaha, and Jefferson on the Salella, Georgia," the type specimen "collected by R. Habersham."

RANGE: Warmer parts of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San Francisquito Mountains, *Brandege* 33 in 1890.

SONORA: Fronteras, *Hartman* 55.

CHIHUAHUA: Mapula Mountains, canyons, *Pringle* 820.

SINALOA: Lodiago, *Palmer* 1665 in 1891.

DURANGO: Durango, Iron Mountain, *Hitchcock* 7622, 7629.

JALISCO: Guadalajara, *Holway* 2; dry open ground along rim of Barranca de Oblatos, *Hitchcock* 7326, 7337, 7369½. Río Blanco, *Palmer* 589 in 1886. Balaños, *Rose* 2956.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

COLIMA: Manzanillo, cliffs by seashore, *Hitchcock* 7045.

MORELOS: Cuernavaca, rocky soil, *Hitchcock* 6877. Yautepec, wet places, *Pringle* 8678.

GUERRERO: Balsas, prairie, *Hitchcock* 6792.

OAXACA: San Antonio, *Conzatti* 2009.

18. *ANTHEPHORA* Schreb. Besch. Gräs. 2: 105. pl. 44. 1779.1. *Antheophora hermaphrodita* (L.) Kuntze, Rev. Gen. Pl. 2: 759. 1891.

*Tripsacum hermaphroditum* L. Syst. Nat. ed. 10. 1261. 1759.

Type locality, Jamaica.

RANGE: Mexico to Brazil.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Cape St. Lucas, *Xantus* 114.

SINALOA: Topolobampo, *Rose, Standley & Russell* 13278. Mazatlán, dry hill, *Rose, Standley & Russell* 13687. Culiacán, moist field, *Rose, Standley & Russell* 14865. Fuerte, river valley, *Rose, Standley & Russell* 13562. Lodi-ego, wet shaded spot on river bank, *Palmer* 1662 in 1891.

TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14228.

COLIMA: Colima, *Palmer* 1255 in 1891, 146 in 1897; *Orcutt* 4567. Armería, weed along railroad, *Hitchcock* 7025. Manzanillo, rocky cliff by seashore, *Hitchcock* 7041; *Palmer* 1093 in 1891.

VERACRUZ: Veracruz, sandy prairie, *Hitchcock* 6558. Jalapa, weed along railroad, *Hitchcock* 6622.

GUERRERO: Acapulco, *Palmer* 38 and 285 in 1895.

OAXACA: Cuicatlán, banks of streams, *Pringle* 6030; *Nelson* 1864.

CHIAPAS: Tonalá, *Nelson* 2906.

YUCATÁN: Mérida, *Schott* 549.

19. *HILARIA* H. B. K. Nov. Gen. & Sp. 1: 116. pl. 37. 1816.

## KEY TO THE SPECIES.

- Spikelet cluster 6 to 7 mm. long, the inner awns of involucre ascending, slender, scabrous..... 1. *H. cenchroides*.  
Spikelet cluster 4.5 to 5 mm. long, the inner awns of involucre recurved-spreading, flattened, ciliate..... 1a. *H. cenchroides ciliata*.

1. *Hilaria cenchroides* H. B. K. Nov. Gen. & Sp. 1: 117. pl. 37. 1816.

CURLY MESQUITE.

*Hilaria cenchroides texana* Vasey, Contr. U. S. Nat. Herb. 1: 53. 1890.

Type locality, "in planitie montana regni Mexicani, inter Zelaya et Guanaxuato, locis subfrigidis."

RANGE: Southwestern United States to Central America.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Guaymas, rocky lava hill, *Hitchcock* 3558; *Palmer* 347 in 1887.

CHIHUAHUA: Chihuahua, hills and plains, *Pringle* 493.

DURANGO: Durango, common in alkaline "bottoms," *Palmer* 541 in 1896; bank of ditch in alkaline flat, *Palmer* 379 in 1896; along road in open ground, *Hitchcock* 7580.

ZACATECAS: Zacatecas, along dry river bed, *Hitchcock* 7537.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7477; *Hartweg* 251.

SAN LUIS POTOSÍ: Alvarez, *Palmer* 165 in 1904. Cárdenas, open grass land, *Hitchcock* 5713.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

JALISCO: Guadalajara, prairie, *Hitchcock* 7268. Río Blanco, *Palmer* 197 in 1886. La Junta, overhanging bank along railway, *Hitchcock* 7000. San Nicolás, prairie, *Hitchcock* 7188. Huejuquilla, *Rose* 2542.

GUANAJUATO: Irapuato, dry shrubby hill, *Hitchcock* 7430. Acámbaro, prairie, *Hitchcock* 6939.

QUERÉTARO: Querétaro, along irrigation ditch, *Hitchcock* 5865, 5870 (much elongated).

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6718½.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6905. Federal District, open grassy pasture, *Hitchcock* 5889. Pedregal, *Hitchcock* 5950. Olivar, *Orcutt* 3591.

PUEBLA: Tochimilco, *Nelson* in 1893. Cholula, *Nicolas* in 1909.

VERACRUZ: Orizaba, open rocky hill, *Hitchcock* 6353.

MORELOS: Cuernavaca, prairie, *Hitchcock* 6861. Yautepec, lava field, *Pringle* 11225.

GUERRERO: Santa Fé, along railroad, *Hitchcock* 6687.

OAXACA: Oaxaca, sterile hill, *Hitchcock* 6096; *Nelson* 1576. Cuicatlán, *Nelson* 1906.

**1a. *Hilaria cenchroides ciliata*** Scribn. Proc. Acad. Phila. 1891: 293. 1892.

Type locality, "Near Guadalajara," the type specimen collected in the Valley of the Rio Grande de Santiago at Atequiza by *Pringle* (no. 3128).

RANGE: Pacific slope of Mexico.

## HERBARIUM SPECIMENS:

TEPIC: Tepic, in deserted garden, *Palmer* 1918 in 1892. Acaponeta, *Rose, Standley & Russell* 14304.

SAN LUIS POTOSÍ: Cárdenas, rocky hill, *Hitchcock* 5774.

JALISCO: Guadalajara, in shady moist place, Barranca de Oblatos, *Hitchcock* 7370. Atequiza, *Pringle* 3128. Zapotlán, along railway, *Hitchcock* 7125.

COLIMA: Manzanillo, *Palmer* 1267 in 1890. Armería, prairie, *Hitchcock* 7022. Alzada, prairie, *Hitchcock* 7077.

**20. *PLEURAPHIS*** Torr. Ann. Lyc. N. Y. 1: 148. pl. 10. 1824.

## KEY TO THE SPECIES.

Culms smooth..... 1. *P. mutica*.  
Culms felty-pubescent..... 2. *P. rigida*.

**1. *Pleuraphis mutica*** Buckl. Proc. Acad. Phila. 1862: 95. 1863.

*Hilaria mutica* Benth. Journ. Linn. Soc. Bot. 19: 62. 1881.

Type locality, "Northern Texas."

RANGE: Southwestern United States to northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, plains, *Pringle* 485. Santa Eulalia Plains, *Wilkinson* in 1885.

COAHUILA: Torreón, among mesquite bushes, *Palmer* 506 in 1898.

**2. *Pleuraphis rigida*** Thurb.; S. Wats. Bot. Calif. 2: 293. 1880. GALLETA.  
*Hilaria rigida* Benth.; Scribn. Bull. Torrey Club 9: 33. 1882.

Type locality, "Fort Mojave," the type specimen collected by Cooper. Thurber (loc. cit.) cites Bolander,<sup>1</sup> the species being mentioned without description and the locality given as "Southern California, Dr. Cooper." The first Cooper specimen mentioned by Thurber is taken as the type.

RANGE: Southwestern United States to northwestern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Canyon Cantillas, *Orcutt* 1145.

SONORA: Colonia Díaz, *Mearns* 2848.

<sup>1</sup> Trans. Agr. Soc. Calif. 1864-5: 137. 1865.



**21. AEGOPOGON** Humb. & Bonpl. in Willd. Sp. Pl. 4: 899. 1806.

## KEY TO THE SPECIES.

- Glumes lanceolate, entire or sometimes obscurely toothed; pediceled spikelets rudimentary; awn of perfect spikelet inconspicuous or wanting. . . . . 3. *A. imperfectus*.
- Glumes cuneate, lobed at the summit; pediceled spikelets well developed; awns usually as long as the spikelet cluster or longer.
- Lobes of glumes rounded, broad and papery. . . . . 2. *A. tenellus*.
- Lobes of glumes acute or awned, firm, purplish. . . . . 1. *A. cenchroides*.

**1. Aegopogon cenchroides** Humb. & Bonpl.; Willd. Sp. Pl. 4: 899. 1806.

*Aegopogon geminiflorus* H. B. K. Nov. Gen. & Sp. 1: 133. 1816.

Type locality, "Cumana," Venezuela.

RANGE: Mexico to Bolivia.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Saucito, *Brandeggee* 69 in 1893 (type of *A. geminiflorus breviglumis* Scribn.,<sup>1</sup> *A. breviglumis* Nash<sup>2</sup>). Sierra de San Francisquito, *Brandeggee* 23 in 1899, 41 in 1890. Sierra de la Laguna, *Brandeggee* 6 in 1890.

CHIHUAHUA: Sánchez, rocky hill, *Hitchcock* 7675. Mapula Mountains, thin soil of ledges, *Pringle* 823. Colonia García, *Townsend & Barber* 340. Cañon de San Diego, *Hartman* 789. Southwestern Mexico, *Palmer* 28 in 1885. Road between Guadalupe y Calvo and San Julián, *Nelson* 4926.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 166, *Parry & Palmer* 942.

JALISCO: Guadalajara, prairie, *Hitchcock* 7267; dry banks, *Pringle* 11731; hills, *Pringle* 3964. Río Blanco, *Palmer* 247 in 1886.

COLIMA: Colima, *Palmer* 1270 in 1891.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6720.

MÉXICO: Popo Park, shady bank, *Hitchcock* 5961, 6024. Popocatepetl, bank of deep cut, *Hitchcock* 5976. Ixtaccihuatl, dry slopes, *Purpus* 48. Federal District, Sierra de Ajusco, *Pringle* 9106; *Holway* 16. Santa Fé, *Bourgeau*.

MORELOS: Cuernavaca, along ditch, *Hitchcock* 6850.

PUEBLA: Cholula, *Deam* in 1899.

VERACRUZ: Jalapa, clay cut, *Hitchcock* 6627. Orizaba, *Müller* 2071, *Botteri*.

OAXACA: Oaxaca, *Nelson* 1367, 1477; *Galeotti* 5750, 5889 in part.

CHIAPAS: San Cristóbal, *Nelson* 3227.

**2. Aegopogon tenellus** (Cav.) Trin. Gram. Unifl. 164. 1824.

*Lamarckia tenella* DC. Hort. Monsp. 120. 1813.

*Cynosurus tenellus* Cav.; DC. Hort. Monsp. 120. 1813.

*Hymenothecium unisetum* Lag. Gen. & Sp. Nov. 4. 1816.

*Aegopogon unisetus* Roem. & Schult. Syst. Veg. 2: 805. 1817.

Type locality, unknown, the type specimen from the Botanical Garden, Montpellier, France.<sup>3</sup>

RANGE: Southern Arizona and northwestern Mexico to northern South America.

<sup>1</sup> Zoe 4: 386. 1894.

<sup>2</sup> N. Amer. Fl. 17: 139. 1912.

<sup>3</sup> Through the kindness of M. C. de Candolle the National Herbarium has received a small portion of the type specimen collected in the Hortus Monspeliensis in 1808 by A. P. de Candolle. This proves to be the species to which Fournier (Mex. Pl. 2: 71. 1886) misapplied the name *Aegopogon geminiflorus* H. B. K.



## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: La Chuparosa, *Brandege* 60 in 1893. Sierra de la Laguna, *Brandege* in 1889 and 1899. El Taste, *Purpus* 535.

SONORA: Without locality, *Coulter* 1656.

CHIHUAHUA: Sánchez, rocky ravine, *Hitchcock* 7707; along railroad, *Hitchcock* 7692. Soldier Canyon, *Jones* in 1903. La Bufa Mountain, moist places, *Pringle* 1407. Southwestern Chihuahua, *Palmer* 153 in 1885. Sierra Madre, *Nelson* 6294.

DURANGO: Barranca below Sandías Station, *Pringle* 13625. Tejaman, *Palmer* 479 in 1906.

ZACATECAS: Plateado, *Rose* 2791.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7473.

SAN LUIS POTOSÍ: Alvarez, *Palmer* 175 in 1902.

JALISCO: Guadalajara, on roof of hotel, *Hitchcock* 7262; *Palmer* 479 and 557 in 1886. Zapotlán, rocky hill, *Hitchcock* 7255. Ferrería, *Jones* 481.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6709, 6735; *Orcutt* 3925.

MICHOACÁN: Uruápan, on stone wall, *Hitchcock* 6982. Morelia, *Arsène* in 1909.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6897; *Rose & Painter* 6763, 6794. Popo Park, *Hitchcock* 5961½. Federal District, fields near Eslaba, *Pringle* 11732; lava fields near Tlálpam, *Pringle* 9582. San Nicolás, *Bourgeau* 1027. Xochimilco, *Orcutt* 4248. Guadalupe, *Rose & Painter* 6822, 6834.

MORELOS: Cuernavaca, rocky cliff, *Hitchcock* 6834. Sierra de Tepoztlán, *Pringle* 9064. Parque Station, *Pringle* 11208.

TLAXCALA: Alpatlahua, *Liebmann* 572.

VERACRUZ: Orizaba, *Botteri* 709, 1207; *Bourgeau* 750b.

OAXACA: *Galeotti* 5750 in part, 5889 in part, 5890. Cuicatlán, *Nelson* 1703. Sierra de San Felipe, *Smith* 914.

CHIAPAS: San Cristóbal, *Nelson* 3135.

**3. *Aegopogon imperfectus* Nash, N. Amer. Fl. 17: 138. 1912.**

Type locality, "Cool mossy ledges, Arroyo Aucho, Sierra Madre, Chihuahua, Mexico," the type specimen collected by *Pringle* (no. 1408).

RANGE: Known only from Chihuahua.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Sierra Madre, Arroyo Aucho, *Pringle* 1408. Southwestern Chihuahua, *Palmer* in 1885.

**22. *NAZIA* Adans. Fam. Pl. 2: 31, 581. 1763.**

**1. *Nazia aliena* (Spreng.) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 28. 1899.**  
*Lappago aliena* Spreng. Neu. Entd. 3: 15. 1822.

Type locality, "Brasilia," the type specimen collected by *Zeyher*.

RANGE: Arizona to Argentina.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandege* in 1902.

SONORA: Santa Cruz, river near La Noria, *Mearns* 1171.

CHIHUAHUA: Chihuahua, hills and plains, *Hitchcock* 7802; *Pringle* 421; *Wilkinson* in 1885.

DURANGO: Durango, dry ground, *Hitchcock* 7600; *Palmer* 763 in 1896. Tlahualilo, barren hills, *Pittier* 472.

COAHUILA: Jaral, *Schumann* 1727. Soledad, *Palmer* 1344 in 1880. Saltillo, waste places, *Palmer* 396 in 1898. White Water, *Mearns* 2260. Sabinas, *Nelson* 6821.

NUEVO LEÓN: Monterey, field, *Hitchcock* 5539.

ZACATECAS: Concepción del Oro, *Palmer* 279 in 1904.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7479.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 151; irrigated alfalfa field, *Hitchcock* 5695; *Parry & Palmer* 952.

QUERÉTARO: Querétaro, open ground on hill, *Hitchcock* 5826.

HIDALGO: Pachuca, sandy river bed, *Hitchcock* 6757.

PUEBLA: San Marcos, railroad fill, *Hitchcock* 6509. Tultitlanapa, *Purpus* 3586.

OAXACA: Tomellín, rocky hill, *Hitchcock* 6216; *Rose, Painter & Rose* 10079.

Oaxaca, weed along railroad, *Hitchcock* 6124; *Conzatti* 2014; *Conzatti & González* 343; *Nelson* 1278.

23. *SCHAFFNERELLA* Nash, N. Amer. Fl. 17: 141. 1912.1. *Schaffnerella gracilis* (Benth.) Nash, N. Amer. Fl. 17: 141. 1912.

*Schaffnera gracilis* Benth. in Hook. Icon. Pl. 14: 59. pl. 1378. 1882.

Type locality, "Mexico; mountains of San Miguelita, in the valley of San Luis Potosí," the type specimen collected by Schaffner (no. 134).

RANGE: Known only from the type collection.

24. *FOURNIERA* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 7. f. 1, 2. 1897.1. *Fourniera mexicana* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 8. f. 1, 2. 1897.

Type locality, "in a deep cut in the mountains near Acapulco, Mexico," the type specimens "growing in loose, gravelly soil," collected by Palmer, October, 1894.

RANGE: Southern Mexico and Central America.

## HERBARIUM SPECIMENS FROM MEXICO:

GUERRERO: Acapulco, *Palmer* 41 and 43 in 1894.

25. *ARUNDINELLA* Raddi, Agrost. Bras. 36. pl. 1. f. 3. 1823.

## KEY TO THE SPECIES.

Awn tightly twisted below..... 1. *A. palmeri*.

Awn straight or only loosely twisted below.

Blades broad and flat, 1 to 2 cm. wide; plants robust, 1.5 to 2

meters tall; sheaths appressed-villous ..... 2. *A. deppeana*.

Blades narrow and more or less folded or convolute; plants slender,

mostly less than 1 meter high; sheaths smooth ..... 3. *A. peruviana*.

1. *Arundinella palmeri* Vasey in Beal, Grasses N. Amer. 2: 76. 1896.

Type locality, "Mexico, Palmer 12" in 1886.

RANGE: Central and southern Mexico.

## HERBARIUM SPECIMENS:

TEPIC: Tepic, low land in cornfield, *Palmer* 1915 in 1892.

JALISCO: Guadalajara, *Palmer* 525 in 1886; wet places, barranca, *Pringle* 11213; by brooks of barranca, *Pringle* 1746; along stream, side of Barranca de Oblatos, *Hitchcock* 7353. Río Blanco, *Palmer* 526 in 1886.

VERACRUZ: Mirador, *Liebmann* 622, 635.

GUERRERO: Acapulco, *Palmer* 434 in 1895.

2. *Arundinella deppeana* Nees in Steud. Syn. Pl. Glum. 1: 115. 1854.

Type locality, "Ad fluv. Misantla, Mexico."

RANGE: American tropics.

## HERBARIUM SPECIMENS FROM MEXICO:

TEPIC: Tepic, river banks and canyons, *Palmer* 1920 in 1892.

COLIMA: Colima, *Palmer* 1264 in 1891.

MICHOACÁN: Sierra Madre, *Langlassé* 608.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

VERACRUZ: Jalapa, river banks, *Pringle* 7764; *Smith* 1892; in low ground among high vegetation, *Hitchcock* 6682. Orizaba, *Botteri* 730, 731, 734. Mirador, *Liebmann* 630. Fortín, *Kerber* 363. Jovo, *Liebmann* 629. Zacuapan, moist open forests, *Purpus* 1997, 3771. Córdoba, low ground, *Hitchcock* 6429. Sanborn, *Orcutt* 3062.

3. *Arundinella peruviana* (Presl) Steud. Syn. Pl. Glum. 1: 115. 1854.

*Thysanachne peruviana* Presl, Rel. Haenk. 1: 253. 1830.

Type locality, "in montanis huanoccensibus Peruviae."

RANGE: Tropical America.

## HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Victoria, *Palmer* 171½ in 1907.

SAN LUIS POTOSÍ: Rascón, *Palmer* 652 in 1905. Tamasopo Canyon, rocky banks of streams, *Pringle* 3133.

JALISCO: Guadalajara, *Palmer* 12 in 1886. Río Blanco, near water, *Palmer* 526 in 1886.

VERACRUZ: Jalapa, moist rich soil, *Hitchcock* 6618. Córdoba, clay bank, *Hitchcock* 6420; bank of cut, *Hitchcock* 6453; *Bourgeau* 1660, 2223. Panuco, *Palmer* 367 in 1910. Mirador, *Liebmann* 621. Cabrestros, *Liebmann* 634. Colipa, *Liebmann* 625. Huitamalco and Tinzutlán, *Liebmann* 632.

OAXACA: San Pedro Nolasco, *Galeotti* 5873, 7863.

26. *LEPTOCORYPHIUM* Nees, Agrost. Bras. 83. 1829.1. *Leptocoryphium lanatum* (H. B. K.) Nees, Agrost. Bras. 84. 1829.

*Paspalum lanatum* H. B. K. Nov. Gen. & Sp. 1: 94. pl. 29. 1816.

Type locality, "in regno Mexicano prope Venta del Cameron et Alto del Peregrino."

RANGE: Tropical America.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Zacuapan, *Purpus* 2451. Tejuco, *Schiede*.

OAXACA: San Juan Guichicovi, *Nelson* 2734.

27. *VALOTA* Adans. Fam. Pl. 2: 495. 1763.

## KEY TO THE SPECIES.

- Blades not over 7 cm. long; spikelets densely silky-pubescent, the hairs not exceeding the spikelets..... 3. *V. hitchcockii*.  
 Blades 10 to 25 cm. long; spikelets clothed with silky hairs much exceeding the spikelet.  
 Pubescence white or nearly so, sometimes purplish..... 2. *V. saccharata*.  
 Pubescence tawny or brown..... 1. *V. insularis*.

1. *Valota insularis* (L.) Chase, Proc. Biol. Soc. Washington 19: 188. 1906.

SOUR GRASS.

*Andropogon insularis* L. Syst. Nat. ed. 10. 2: 1304. 1759.

Type locality, Jamaica.

RANGE: Tropics and subtropics of the western hemisphere.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, *Palmer* 207 in 1885.

SINALOA: Culiacán, *Palmer* 1553 in 1891. Villa Unión, open field, *Rose, Standley & Russell* 13916.

DURANGO: Durango, in the mountains, *Palmer* 715 in 1896; rocky hill, Iron Mountain, *Hitchcock* 7631.

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5528.

TAMAULIPAS: Tampico, *Palmer* 151 in 1910.

TEPIC: Between Concepción and Acaponeta, *Rose* 1900.

SAN LUIS POTOSÍ: Las Canóas, along railway, *Hitchcock* 5769.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

JALISCO: Guadalajara, along stream, side of Barranca de Oblatos, *Hitchcock* 7352.

COLIMA: Paso del Río, *Emrick* 199. Caldras, along railway, *Hitchcock* 7019.

PUEBLA: Tehuacán, cactus hill, *Hitchcock* 6091.

VERACRUZ: Córdoba, waste places, *Hitchcock* 6415. Zacuapan, *Purpus* 3778.

Sanborn, *Orcutt* 3070.

MORELOS: Cuernavaca, edge of orchard, *Hitchcock* 6858.

GUERRERO: Acapulco, *Palmer* 288 in 1895.

OAXACA: Oaxaca, along railway, *Hitchcock* 6119; in water of ditch, *Hitchcock* 6183. Tomellín, along railway, *Hitchcock* 6221; *Rose* 3638. Tuxtepec, *Nelson* 341.

YUCATÁN: Progreso, *Millsbaugh* 1681.

2. *Valota saccharata* (Buckl.) Chase, Proc. Biol. Soc. Washington 19: 188. 1906.

*Panicum saccharatum* Buckl. Prel. Rep. Geol. Agr. Surv. Tex. App. 2. 1866.

Type locality, "Middle Texas."

RANGE: Southwestern United States to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Guaymas, rocky lava hill, *Hitchcock* 3544; *Palmer* 348 in 1887. Nogales to Cocospora Ranch, *Griffiths* 6794.

CHIHUAHUA: Chihuahua, rocky hills, *Pringle* 378; *Palmer* 207 in 1885, 343 in 1908; rocky hill, *Hitchcock* 7791.

SINALOA: Topolobampo, *Palmer* 243 in 1897.

DURANGO: Torreón, rocky hill, *Hitchcock* 7540. Tlahualilo, barren hills, *Pittier* in 1905. Durango, among loose rocks on hillside, *Palmer* 949 in 1896; rocky hill, Iron Mountain, *Hitchcock* 7628.

COAHUILA: Monclova, *Palmer* 1341 in 1880. Saltillo, rocky hill, *Hitchcock* 5615. Sabinas, *Nelson* 6826.

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5543, 5546.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 177; edge of field, *Hitchcock* 5702.

HIDALGO: Ixmiquilpan, limestone hillside, *Rose, Painter & Rose* 8902.

PUEBLA: Tehuacán, cactus hill, *Hitchcock* 6090.

3. *Valota hitchcockii* Chase, Proc. Biol. Soc. Washington 24: 110. 1911.

Type locality, "dry prairie soil, San Antonio, Texas," the "type collected June 24, 1910, by A. S. Hitchcock (no. 5329)."

RANGE: Texas to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Monterey, rocky hill among shrubs, *Hitchcock* 5521.

SAN LUIS POTOSÍ: San Luis Potosí, along railroad cut, *Hitchcock* 5730.

28. *SYNTHERISMA* Walt. Fl. Carol. 76. 1788.

## KEY TO THE SPECIES.

## Plants annual.

Rachis beset with scattered, spreading long hairs. . . . . 5. *S. digitata*.

Rachis with no long hairs.

Rachis winged, triangular; pedicels angled; culms creeping . . . . . 6. *S. sanguinalis*.

Rachis not winged; pedicels terete; culms not creeping. . . . . 7. *S. filiformis*.

## Plants perennial.

Plants caespitose, not producing stolons; sheaths not velvety.

Spikelets brown-pubescent at maturity. . . . . 1. *S. badia*.

Spikelets white-pubescent. . . . . 2. *S. leucocoma*.



Plants stoloniferous.

Spikelets glabrous, distant..... 4. *S. distans*.

Spikelets with lines of dense silky pubescence.

Sheaths and blades velvety-pubescent..... 3. *S. velutina*.

Sheaths, except those of the stolons, glabrous  
or nearly so..... 3a. *S. velutina glabella*.

1. ***Syntherisma badia*** (Scribn. & Merr.) Chase, Proc. Biol. Soc. Washington **19**: 191. 1906.

*Panicum badium* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. **24**: 12. f. 3. 1901.

Type locality, "Sierra de San Felipe, State of Oaxaca," the type specimen collected by Smith (no. 915).

RANGE: Southern Mexico.

HERBARIUM SPECIMENS:

JALISCO: Zapotlán, pine woods, *Hitchcock* 7243.

MICHOACÁN: Uruápan, prairie, *Hitchcock* 6983.

OAXACA: Sierra de San Felipe, *Smith* 915.

2. ***Syntherisma leucocoma*** Nash, Bull. Torrey Club **25**: 295. 1898.

Type locality, "high pine land, Florida \* \* \* Lake Ella, Lake Co."

RANGE: Southeastern United States, Cuba, and Gulf region of Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Jalapa, prairie, *Hitchcock* 6656; railway cut, *Hitchcock* 6678. Orizaba, open rocky hill, *Hitchcock* 6350.

3. ***Syntherisma velutina*** (DC.) Chase, Proc. Biol. Soc. Washington **19**: 191. 1906.

*Milium velutinum* DC. Cat. Hort. Monsp. 126. 1813.

Type locality, "Mexico."

RANGE: Southern Mexico and Central America.

HERBARIUM SPECIMENS FROM MEXICO:

MICHOACÁN: Uruápan, prairie, *Hitchcock* 6973, 6974.

MÉXICO: Toluca, weed in field on rocky hill, *Hitchcock* 6916; among agaves, *Hitchcock* 6918. Amecameca, fields, *Purpus* 1636. Federal District, Xochimilco, along ditch, *Hitchcock* 5882. Base of Sierra de Ajusco, sandy fields, *Pringle* 6623. Eslava, *Pringle* 9565.

PUEBLA: Cerro Guadalupe, dry hills, *Nicolas* 1909.

- 3a. ***Syntherisma velutina glabella*** Chase, subsp. nov.

Plants perennial, more strongly stoloniferous than in the species; culms and nodes glabrous; culm sheaths glabrous or nearly so, those of the young shoots arising from the stolons velvety-pubescent, much less so than in the species; inflorescence as in the species, the racemes 4 to 8, 6 to 15 cm. long, scattered on a common axis 2 to 5 cm. long; spikelets bluish purple, 3 mm. long; first glume minute, hyaline; second glume and sterile lemma with rows of dense, appressed silky hairs on the lateral inter-nerves; fruit lead color.

Type in the U. S. National Herbarium, no. 691224, "erect from creeping, stoloniferous base," collected in prairie, 1,700 meters altitude, Uruápan, Michoacán, Mexico, September 16, 1910, by A. S. Hitchcock (no. 6989).

RANGE: Southern Mexico.

HERBARIUM SPECIMENS:

VERACRUZ: Veracruz, sandy prairie, *Hitchcock* 6554.

MICHOACÁN: Uruápan, clay bank, *Hitchcock* 6977, 6989. Pátzcuaro, *Holway* 3212.

4. ***Syntherisma distans*** Chase, sp. nov.

Plants perennial, stoloniferous, the compressed culms ascending from the nodes of a slender widely creeping stoloniferous base; flowering culms simple, very slender,



60 to 70 cm. high, glabrous, the lower nodes and especially those of the young shoots spreading-villous, the upper nodes glabrous or nearly so, the internodes rather conspicuously yellow; sheaths shorter than the internodes, retrorsely villous toward the base; ligule about 2 mm. long, extending down the sheath as a scarious margin; blades ascending or the lower spreading, flat, 3 to 6 cm. long, about 2 mm. wide (the uppermost sometimes reduced to a mere tip), more or less scabrous on both surfaces, the lower sometimes sparsely pilose; inflorescence finally long-exserted, consisting of 2 to 4 slender ascending racemes 6 to 11 cm. long, usually naked at the base, the rachises very slender, triangular, scabrous on the angles; spikelets in pairs (or the upper and lower solitary), one short-pedicel, the other on a slender pedicel about as long as the lower spikelet, the pairs subdistant; spikelets 3 mm. long, about 1 mm. wide, acuminate; first glume subhyaline, less than 0.5 mm. long; second glume and sterile lemma glabrous, 7-nerved, exceeding the fruit, the glume slightly longer than the lemma; fruit 2.5 mm. long, bluish lead color except the rather broad white hyaline margin.

Type in the U. S. National Herbarium, no. 691225, collected "on the bank of a large pond, 1,800 meters altitude, Orozco, Jalisco, Mexico, September 29, 1910," by A. S. Hitchcock (no. 7376).

The only other specimen seen is from the same locality, growing "in and near the water," *Hitchcock* 7372.

*Syntherisma distans* differs from *S. aequiglumis* (Hack. & Arech.) Hitchc. in its more stoloniferous habit, much scantier foliage, fewer, longer, and more slender racemes, and the glabrous, less acuminate, more distant spikelets. Notwithstanding its being nearly glabrous, it is probably more nearly related to *S. velutina* than to the *S. sanguinalis* group to which *S. aequiglumis* belongs.

**5. *Syntherisma digitata* (Swartz) Hitchc. Contr. U. S. Nat. Herb. 12: 142. 1908.**

*Milium digitatum* Swartz, Prodr. Veg. Ind. Occ. 24. 1788.

*Digitaria setosa* Desv.; Hamilt. Prodr. Fl. Ind. Occ. 6. 1825.

Type locality, "Jamaica."

RANGE: Tropics and subtropics of the western hemisphere.

HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Tampico, *Palmer* 145 in 1910; low brushy land, *Hitchcock* 5780.

COLIMA: Jala, along railway, *Hitchcock* 7009. Caldras, along railway, *Hitchcock* 7017. Alzada, upland prairie, *Hitchcock* 7069. Colima, *Orcutt* 4541.

VERACRUZ: Veracruz, sandy prairie, *Hitchcock* 6566.

GUERRERO: Balsas, gravel along railway, *Hitchcock* 6778, 6809.

CHIAPAS: Ocuilapa, table-land, *Nelson* 3049.

**6. *Syntherisma sanguinalis* (L.) Dulac, Fl. Haut. Pyr. 77. 1867. CRAB GRASS.**

*Panicum sanguinale* L. Sp. Pl. 57. 1753.

Type locality, "Habitat in America, Europa australi."

RANGE: Temperate and warmer regions of the world.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandeggee* 17, 29, 41. Santa Agueda, *Palmer* 222 in 1890. Sierra de San Francisquito, *Brandeggee* 26.

SONORA: Guaymas, *Palmer* 48, 269, and 695 in 1887; weed in park, *Hitchcock* 3570. Hermosillo, cultivated soil, *Hitchcock* 3588. Yaqui River, *Palmer* 3 in 1869. Alamos, *Palmer* 685 in 1890. Sierra de Alamos, *Rose, Standley & Russell* 12983.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 110f in 1885. Sánchez, along railway, *Hitchcock* 7695.

SINALOA: Imala, in dense patches along river banks, *Palmer* 1757 and 1764 in 1891. Topolobampo, *Palmer* 234 in 1897, *Rose, Standley & Russell* 13277. Mazatlán, dry hill, *Rose, Standley & Russell* 13675; old field *Rose, Standley & Russell*



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

14166. Rosario, along river, *Rose* 1541, *Rose, Standley & Russell* 14586. Culiacán, *Rose, Standley & Russell* 14972.
- DURANGO: Durango, in fields and along fences, *Palmer* 766 in 1896. Torreón, weed in field, *Hitchcock* 7556.
- COAHUILA: Saltillo, in shaded gardens, *Palmer* 387 in 1898; weed along street, *Hitchcock* 5638.
- TAMAULIPAS: Victoria, *Palmer* 551 in 1907. Tampico, depression in sand dunes, *Hitchcock* 5795.
- TEPIC: Tepic, *Palmer* 1929 in 1892. Tres Mariás Islands, María Magdalena, *Maltby* 158. Acaponeta, moist ravine, *Rose, Standley & Russell* 14269.
- SAN LUIS POTOSÍ: Cárdenas, irrigated field, *Hitchcock* 5746.
- JALISCO: Guadalajara, prairie, *Hitchcock* 7283. San Nicolás, prairie, *Hitchcock* 7186. Zapotlán, railway right of way, *Hitchcock* 7139.
- GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6940. Irapuato, moist sandy-clay plain, *Hitchcock* 7391.
- QUERÉTARO: Querétaro, weed in park, *Hitchcock* 5839.
- COLIMA: Alzada, upland prairie, *Hitchcock* 7068. Colima, deep ravine, *Palmer* 9 and 148 in 1897. Paso del Río, *Emrick* 182. Manzanillo, *Palmer* 1082 in 1890.
- MICHOACÁN: Morelia, *Arsène* in 1909. Uruápan, along road, *Hitchcock* 6976.
- VERACRUZ: Orizaba, *Botteri, Bourgeau* 2636. Río Blanco, roadside ditch, *Hitchcock* 6321. Jalapa, railway track, *Hitchcock* 6598. Córdoba, waste places, *Hitchcock* 6408; *Fink* 6. San Sebastián, *Liebmann* 208. Sanborn, *Orcutt* 3244.
- MORELOS: Cuernavaca, pasture, *Hitchcock* 6829.
- GUERRERO: Balsas, along railway, *Hitchcock* 6796. Acapulco, ravine, *Palmer* 112 in 1894; dry river bed, 446 in 1895.
- OAXACA: Oaxaca, along hedge, *Hitchcock* 6111. Valley of Oaxaca, *Nelson* 1275. Tomellín, along ditch, *Hitchcock* 6206; *Rose, Painter & Rose* 10064.
- TABASCO: San Juan Bautista, *Rovirosa* 20.
- CHIAPAS: Valley of Jiquipilas, *Nelson* 2932.
- YUCATÁN: Progreso, *Millspaugh* 1700.

7. *Syntherisma filiformis* (L.) Nash, Bull. Torrey Club 22: 420. 1895.

*Panicum filiforme* L. Sp. Pl. 57. 1753.

Type locality, "Habitat in America septentrionali. Kalm."

RANGE: Temperate and subtropical regions of the western hemisphere.

## HERBARIUM SPECIMENS FROM MEXICO:

- CHIHUAHUA: Dry hillsides near Guerrero, *Pringle* 1405.
- DURANGO: Durango, in loose, clay soil, *Palmer* 548 in 1896.
- JALISCO: Río Blanco, *Palmer* 502 in 1886. Guadalajara, *Holway* 4; *Palmer* 502 in 1886; prairie, *Hitchcock* 7265, 7286. Zapotlán, railway right of way, *Hitchcock* 7135; rocky hill, *Hitchcock* 7177, 7252. La Junta, along railway, *Hitchcock* 6998. San Nicolás, sterile clay hill, *Hitchcock* 7210.
- VERACRUZ: Totutla, *Liebmann* 206.
- MORELOS: Cuernavaca, along railway, *Hitchcock* 6864; pasture, *Hitchcock* 6828.
- OAXACA: Hills of Las Sedas, dry gravelly soil, *Pringle* 4942. Oaxaca, rocky hill in clay loam, *Hitchcock* 6104.
- CHIAPAS: Tuxtla to San Cristóbal, roadside, *Nelson* 3118.

29. *LEPTOLOMA* Chase, Proc. Biol. Soc. Washington 19: 191. 1906.1. *Leptoloma cognatum* (Schult.) Chase, Proc. Biol. Soc. Washington 19: 192. 1906.

*Panicum cognatum* Schult. Mant. 2: 235. 1824.

Type locality, "Habitat in Carolina."



RANGE: Central and southern United States to central Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, hills and plains, *Pringle* 489; rocky hill, *Hitchcock* 7992.

COAHUILA: Sabinas, *Nelson* 6822.

NUEVO LEÓN: Monterey, agave field, *Hitchcock* 5527.

SAN LUIS POTOSÍ: Cárdenas, railway cut, *Hitchcock* 5732. Sierra de Guascama, *Purpus* 5430.

30. **ECHINOLAENA** Desv. Journ. de Bot. 1: 75. 1813.

1. **Echinolaena polystachya** H. B. K. Nov. Gen. & Sp. 1: 119. 1816.

*Panicum uncinatum* Raddi, Agrost. Bras. 41. 1823.

Type locality, "in ripa fluminis Magdalenae inter Tenerife et Zambrano," Colombia.

RANGE: American tropics.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Córdoba, shady rich loam under coffee trees, *Hitchcock* 6438; banks of rivers, *Seaton* 432. Jalapa, railway cut through jungle, *Hitchcock* 6641.

Along railway near Coatepec, *Hitchcock* 6664. Potrero de San Sebastián, *Liebmann* 396. Zacuapan, Barranca de Tenampa, moist banks, *Purpus* 1999.

OAXACA: Comaltepec, *Galeotti* 5857.

31. **ERIOCHLOA** H. B. K. Nov. Gen. & Sp. 1: 94. pl. 30, 31. 1816.

KEY TO THE SPECIES.

Fruit bearing an awn nearly as long as the fertile lemma..... 1. *E. punctata*.

Fruit mucronate or short-awned.

Blades smooth or nearly so; hairs of pedicels not conspicuous.

Second glume tapering into an awn about as long as the body; spikelet exclusive of awn about 5 mm. long.. 3. *E. aristata*.

Second glume acute or short-awned; spikelet about 4 mm. long..... 2. *E. polystachya*.

Blades velvety; hairs of pedicels conspicuous, as long as spikelet.

Spikelets 4 mm. long..... 4. *E. lemmoni*.

Spikelets 6 mm. long..... 5. *E. nelsoni*.

1. **Eriochloa punctata** (L.) Hamilt. Prodr. Fl. Ind. Occ. 5. 1825.

*Miliusa punctatum* L. Syst. Nat. ed. 10. 872. 1759.

Type locality, Jamaica.

RANGE: Southern United States to South America.

HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Monterey, irrigation ditch, *Hitchcock* 5576.

VERACRUZ: Córdoba, *Hitchcock* 6406; low woods along ditch, *Hitchcock* 6224; low ground along railway, *Hitchcock* 6431. Orizaba, roadside ditch, *Hitchcock* 6324, 6341; *Botteri* 717.

MORELOS: Valley near Jojutla, *Pringle* 9605.

2. **Eriochloa polystachya** H. B. K. Nov. Gen. & Sp. 1: 95. pl. 31. 1816.

Type locality, "in pascuis inundatis prope Guayaquil (Regno Quit.)" Ecuador.

RANGE: Tropics of continental America.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: South of Nogales, *Hitchcock* 3627. Llano, along railway, *Hitchcock* 3522.

Hermosillo, meadow, *Hitchcock* 3584. Guaymas, weed in park, *Hitchcock* 3571; *Palmer* 44 in 1887. Yaqui River, *Palmer* 4 in 1869.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

CHIHUAHUA: Miñaca, along railway, *Hitchcock* 7753. Sánchez, along railway, *Hitchcock* 7703. Chihuahua, along dry run, *Hitchcock* 7778; hills and plains, *Pringle* 812.

SINALOA: Topolobampo, *Palmer* 242 in 1897.

DURANGO: Durango, water of ditch, *Hitchcock* 7656; low, moist places on hill-sides, *Palmer* 524 in 1896; among rocks and agave plants, *Palmer* 736 in 1896.

Tepehuanes, *Palmer* 532 in 1906. Torreón, weed in field, *Hitchcock* 7557.

AGUASCALIENTES: Aguascalientes, along ditch, *Hitchcock* 7480.

JALISCO: San Nicolás, weed in field, *Hitchcock* 7228. Guadalajara, prairie, *Hitchcock* 7319.

GUANAJUATO: Acámbaro, along ditch, *Hitchcock* 6926. Irapuato, moist sandy-clay plain, *Hitchcock* 7406.

QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5805.

COLIMA: Alzada, upland prairie, *Hitchcock* 7063.

GUERRERO: Balsas, along railway, *Hitchcock* 6812. Santa Fé, along railway, *Hitchcock* 6691.

OAXACA: Oaxaca, along hedge, *Hitchcock* 6108; along ditch between Tule and Oaxaca, *Hitchcock* 6169.

3. *Eriochloa aristata* Vasey, Bull. Torrey Club 13: 229. 1886.

Type locality, "S. W. Chihuahua," the type specimen collected by Palmer.

RANGE: Southwestern United States and northwestern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Hermosillo, along ditch, *Hitchcock* 3539. Alamos, *Palmer* 692 in 1890.

SINALOA: Culiacán, *Brandegge* in 1904.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 110e in 1885.

4. *Eriochloa lemmoni* Vasey & Scribn. Bot. Gaz. 9: 185. pl. 2. 1884.

Type locality, "Arizona (no. 2910 Lemmon, 1882)."

RANGE: Southwestern United States to Sinaloa, Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Imala, *Palmer* 1762 in 1891.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 110a in 1885.

5. *Eriochloa nelsoni* Scribn. & Smith, Bull. U. S. Dept. Agr. Div. Agr. 4: 12. 1897.

Type locality, "hills east of Cuicatlan, Oaxaca, Mexico," the type specimen collected by Nelson (no. 1707).

RANGE: South central Mexico to Central America.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, dry shaded ledges, *Pringle* 2317; side of Barranca de Oblatos, *Hitchcock* 7349.

MORELOS: Yautepec, lava fields, *Pringle* 11224.

GUERRERO: Balsas, rocky hill, *Hitchcock* 6784.

OAXACA: Cuicatlán, hills, *Nelson* 1707.

32. *BRACHIARIA* (Trin.) Griseb. in Ledeb. Fl. Ross. 4: 469. 1853.

## KEY TO THE SPECIES.

Spikelets 3 mm. long; blades ciliate..... 2. *B. meiziana*.  
Spikelets 5 mm. long; blades not ciliate..... 1. *B. plantaginea*.

1. *Brachiaria plantaginea* (Link) Hitchc. Contr. U. S. Nat. Herb. 12: 212. 1909.

*Panicum plantagineum* Link, Hort. Berol. 1: 206. 1827.

Type locality unknown.



RANGE: Southern United States to South America.

HERBARIUM SPECIMENS FROM MEXICO:

DURANGO: Durango, dry ground, *Hitchcock* 7576, *Palmer* in 1896.

AGUASCALIENTES: Aguascalientes, along pond, *Hitchcock* 7488.

SAN LUIS POTOSÍ: Las Canóas, open moist soil, *Hitchcock* 5758; fields, *Pringle* 3904. Cárdenas, irrigated field, *Hitchcock* 5752.

JALISCO: San Nicolás, prairie, *Hitchcock* 7192. Zapotlán, railway right of way, *Hitchcock* 7136. Guadalajara, prairie, *Hitchcock* 7320.

GUANAJUATO: Acámbaro, along ditch, *Hitchcock* 6937. Irapuato, moist sandy-clay plain, *Hitchcock* 7410.

COLIMA: Jala, along railway, *Hitchcock* 7010. Colima, *Orcutt* 4616.

MICHOACÁN: Uruápan, weed in cornfield, *Hitchcock* 6990.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6315. Jalapa, weed along railway, *Hitchcock* 6653. Córdoba, *Hitchcock* 6405.

MORELOS: Cuernavaca, weed in garden, *Hitchcock* 6853; *Orcutt* 3890.

OAXACA: Oaxaca, weed in field, *Hitchcock* 6122. Valley of Oaxaca, *Conzatti & González* 350a.

2. *Brachiaria meziana* Hitchc. Contr. U. S. Nat. Herb. 12: 140. 1908.

Type locality, "low moist places on the plains of Mexico," Federal District, the type specimen collected by *Pringle* (no. 9592).

RANGE: Throughout interior Mexico.

HERBARIUM SPECIMENS:

CHIHUAHUA: Valley near Chihuahua, *Pringle* 375.

DURANGO: Durango, low bottom lands, *Palmer* 533 in 1896; prairie of valley, *Hitchcock* 7619.

COAHUILA: Saltillo, along small irrigation ditch, *Hitchcock* 5593.

ZACATECAS: Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7516.

AGUASCALIENTES: Aguascalientes, along ditch, *Hitchcock* 7492.

SAN LUIS POTOSÍ: Cárdenas, along railway, *Hitchcock* 5770. San Luis Potosí, alfalfa field, *Hitchcock* 5668.

JALISCO: Río Blanco, *Palmer* 254 in 1886. San Nicolás, cornfield, *Hitchcock* 7225.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7416. Acámbaro, along railway, *Hitchcock* 6928.

QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5802.

MÉXICO: Xochimilco, pasture, *Hitchcock* 5891. Federal District, San Angel, *Bourgeau* 222; *Orcutt* 3692; prairies near Mexico City, *Bourgeau* 430; Cerro de Guadalupe, *Pringle* 9592.

PUEBLA: Puebla, *Nelson* in 1893.

OAXACA: Valley of Oaxaca, *Conzatti & González* 348.

33. *AXONOPUS* Beauv. Ess. Agrost. 12, 154. 1812.

KEY TO THE SPECIES.

Plants stoloniferous; blades 5 to 12 mm. wide.

Racemes 2 or 3, rarely 4, less than 10 cm. long; spikelets pubescent, acuminate..... 2. *A. compressus*.

Racemes 6 or more, 10 to 25 cm. long; spikelets glabrous, blunt. 1. *A. deludens*.

Plants erect, not stoloniferous; blades not over 4 mm. wide, usually less.

Spikelets 4 mm. long..... 5. *A. rosei*.

Spikelets less than 3 mm. long.

Racemes 3 to several; nodes pubescent..... 4. *A. laxiflorus*.

Racemes 2 or 3; nodes glabrous..... 3. *A. marginatus*.



**1. *Axonopus deludens*** Chase, Proc. Biol. Soc. Washington **24**: 134. 1911.

Type locality, "Barranca near Guadalajara, Jalisco, Mexico, the type specimen collected by Pringle (no. 8761)."

RANGE: Known only from the type collection.

**2. *Axonopus compressus*** (Swartz) Beauv. Ess. Agrost. 12. 1812. CARPET GRASS.

*Milium compressum* Swartz, Prodr. Veg. Ind. Occ. 24. 1788.

Type locality, "Jamaica."

RANGE: Tropics and subtropics of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Culiacán, abundant in underbrush along arroyos, *Palmer* 1760 in 1891.

COLIMA: Manzanillo, pasture, *Hitchcock* 7033.

VERACRUZ: Córdoba, grassy bank, *Hitchcock* 6449; along cut, *Hitchcock* 6427; *Kerber* 38. Jalapa, clay cut, *Hitchcock* 6588. Veracruz, sandy prairie, *Hitchcock* 6578.

GUERRERO: Acapulco, *Palmer* 420 in 1895.

**3. *Axonopus marginatus*** (Trin.) Chase.

*Paspalum marginatum* Trin. Gram. Pan. 90. 1826.

Type locality, "Brasil." The type specimen in the Trinius Herbarium is labeled "In pratis siccis glareosis S. de Lapa. Brasil. Langsdorff."

RANGE: Southern Mexico to Paraguay.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Zacuapan, dry soil, *Purpus* 2450. Fortín, moist soil, *Purpus* 2155.

Jalapa, clay cut, *Hitchcock* 6628. Mirador, *Liebmann* 203.

**4. *Axonopus laxiflorus*** (Trin.) Chase, Proc. Biol. Soc. Washington **24**: 133. 1911.

*Paspalum laxiflorum* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 1: 148. 1834.

Type locality, Serra da Lapa, Brazil.

RANGE: Southern Mexico to southern Brazil.

## HERBARIUM SPECIMENS FROM MEXICO:

OAXACA: Between Guichocovi and Lagunas, *Nelson* 2738.

**5. *Axonopus rosei*** (Scribn. & Merr.) Chase, Proc. Biol. Soc. Washington **24**: 132. 1911.

*Paspalum rosei* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. **24**: 9. f. 2. 1900.

Type locality, "Foothills of the Sierra Madre Mountains, between Pedro Paulo and San Blascito," the type specimen collected by Rose (no. 1995).

Known only from the type specimen.

**34. PASPALUM L.** Syst. Nat. ed. 10. 855. 1759.<sup>1</sup>

## KEY TO THE SPECIES.

Rachis with broad membranaceous wings more or less infolding the spikelets (or the latter, if not infolded, long-silky).

Spikelets clothed with long silky hairs.

Rachis 5 to 7 mm. wide, the margins rufous..... 5. *P. stellatum*.

Rachis 2 to 3 mm. wide, the margins dull green or brown.

Blades not ciliate; second glume and sterile lemma glabrous except for the long-ciliate margins. . 6. *P. cymbiforme*.

Blades papillose-ciliate on the margin; glume and usually the sterile lemma pubescent on the back; plants tufted, producing stout running rootstocks..... 7. *P. humboldtianum*.

<sup>1</sup> Contributed by Agnes Chase.



Spikelets glabrous or minutely pubescent only; rachis green.

Racemes 30 or more, approximate, the rachis scabrous; spikelets pointed; aquatic plants, the sheaths of the floating stems inflated, bladder-like.

Spikelets in 2 rows, more or less pubescent, about 0.8 mm. wide..... 1. *P. repens*.

Spikelets in a single row, glabrous, about 1.2 mm. wide, the tip of the rachis elongated..... 2. *P. longicuspe*.

Racemes 4 to 12, scattered, the rachis glabrous; plants terrestrial.

Spikelets pointed, 3.5 to 4 mm. long, imbricated, green..... 3. *P. acuminatum*.

Spikelets blunt, 2 to 2.2 mm. long, alternate, not imbricated, white..... 4. *P. prostratum*.

Rachis without broad membranaceous wings, or if somewhat winged, the spikelets not long-silky.

Fertile lemma with five longitudinal ridges; both glumes wanting (§ ANACHYRIS)..... 40. *P. malacophyllum*.

Fertile lemma not ridged (§ OPISTRION).

Racemes 2, conjugate at the summit of the culm, rarely a third below; spikelets solitary (see also *P. claviferum*).

Spikelets elliptical or ovate; first glume occasionally present; plants with extensively creeping rootstocks.

Second glume not wrinkled, the sterile lemma pubescent..... 9. *P. distichum*.

Second glume wrinkled in the internerves; spikelets glabrous..... 8. *P. vaginatum*.

Spikelets nearly orbicular to obovate.

Racemes slender, elongated; spikelets concavo-convex, light yellow, sparsely long-silky around the margin; plants stoloniferous. 10. *P. conjugatum*.

Racemes rather stout, not elongated; spikelets plano-convex, green, glabrous; plants with short stout rootstocks but not stoloniferous.

Spikelets 2 to 2.5 mm. long..... 26. *P. minus*.

Spikelets 3 to 3.8 mm. long..... 25. *P. notatum*.

Racemes 1 to many, racemose on the axis, not conjugate at the summit of the culm, or if occasionally so the spikelets in pairs.

Fruit dark brown, polished; second glume and sterile lemma thin, fragile.

Plants perennial, erect; second glume transversely wrinkled inside the margin..... 23. *P. plicatulum*.

Plants annual, more or less spreading or prostrate; second glume not wrinkled ..... 24. *P. convexum*.

Fruit not dark brown (brown but not polished in *P. virgatum*).

Spikelets clothed with long silky hairs; lower sheaths densely appressed-villous..... 39. *P. erianthum*.



Spikelets glabrous or pubescent, the pubescence short, not silky.

First glume present at least on the lower of the pair of spikelets (sometimes wanting toward the base of the raceme).

Plants annual, coarse, about 2 meters high; first glume inconspicuous, the second and the sterile lemma subchartaceous, glabrous..... 35. *P. crassum*.

Plants perennial, rarely over 1 meter high; glumes and sterile lemma thin.

Plants with stout running rootstocks, glaucous; raceme erect, usually single; spikelets glabrous, narrowly obovate, acute; first glumes well developed, dissimilar on the pair of spikelets..... 38. *P. unispicatum*.

Plants without running rootstocks, not glaucous; racemes 2 to several or, if single, not erect.

Spikelets glabrous; first glume obsolete on the upper of the pair of spikelets. 16. *P. culiacanum*.

Spikelets pubescent.

Spikelets 3.2 to 3.4 mm. long; first glumes well developed, that of the upper spikelet with a scarious undulate border..... 19. *P. variabile*.

Spikelets not over 3 mm. long, the first glume commonly obsolete in the upper spikelet, not having a scarious undulate border.

Blades usually 15 mm. wide or more; spikelets about 2.5 mm. long.... 18. *P. planifolium*.

Blades rarely as much as 12 mm. wide; spikelets about 2.2 mm. long..... 17. *P. langei*.

First glume wanting, or only exceptionally present on a few spikelets (see also *P. crassum* with inconspicuous first glume).

Racemes numerous, usually 20 or more, approximate.

Spikelets about 1.3 mm. long, strongly plano-convex..... 22. *P. paniculatum*.

Spikelets 2 mm. or more long, not strongly convex, more or less ciliate around the edge; plants robust.

Plants stoloniferous, widely creeping; inflorescence V-shaped in outline; spikelets narrowly ovate, 4 to 4.5 mm. long, solitary..... 32. *P. fasciculatum*.

Plants not stoloniferous; inflorescence oblong.

Lower sheaths hirsute, not reticulate; spikelets 2 mm. long..... 34. *P. conspersum*.



- Lower sheaths glabrous, reticulate-nerved; spikelets 3 mm. or more long..... 33. *P. virgatum*.
- Racemes 1 to several, rarely as many as 15, not approximate.
- Spikelets minute, not over 1.3 mm. long; plants annual.
- Plants caespitose; blades linear, pilose; second glume glandular-pubescent. 12. *P. clavuliferum*.
- Plants stoloniferous; blades lanceolate, glabrous or nearly so; spikelets glabrous and with a ring-like margin, the midnerve of the sterile lemma suppressed..... 11. *P. orbiculatum*.
- Spikelets 1.5 mm. or more long; plants perennial.
- Culms decumbent at base, rooting at the nodes (occasional plants in dry situations erect from the base), branching; spikelets acute or subacute, 2.4 mm. or more long; rachis about 2 mm. wide; plants of moist ground.
- Spikelets glabrous, lurid purplish; axis of inflorescence slender, flexuous..... 29. *P. lividum*.
- Spikelets pubescent.
- Axis of inflorescence slender, subflexuous; spikelets not strongly convex..... 30. *P. buckleyanum*.
- Axis of inflorescence stout, not flexuous; spikelets strongly convex..... 31. *P. pubiflorum*.
- Culms erect or ascending, not rooting at the nodes; spikelets usually obtuse.
- Plants with stout scaly rootstocks; culms solitary; spikelets elliptic, subacute..... 37. *P. jaliscanum*.
- Plants without scaly rootstalks; culms tufted.
- Spikelets 2.5 mm. or more long, not turgid; culms tall, simple.
- Sheaths and blades, at least the lower, densely and softly grayish-villous; spikelets elliptical; racemes spreading.. 28. *P. crinitum*.
- Sheaths glabrous or pilose along the margin toward the summit, papillose-pilose at the junction with the blade; blades glabrous beneath, conspicuously pilose near the base above; spikelets broadly obovate; racemes erect..... 27. *P. glaberrimum*.



Spikelets not over 2 mm. long,  
turgid.

Racemes 1 to 3 at the summit of  
the culm, naked, raceme-  
bearing branches from the  
upper sheaths; culms slender;  
spikelets broadly obovate.

Spikelets glabrous..... 15. *P. stramineum*.  
Spikelets pubescent.

Blades ciliate on the margin,  
otherwise glabrous or  
nearly so..... 14. *P. ciliatifolium*.

Blades pilose on the upper  
surface, more or less pu-  
bescent beneath..... 13. *P. setaceum*.

Racemes 4 to 12.

Spikelets glabrous; plants  
branching..... 20. *P. squamulatum*.

Spikelets densely pubescent.

Spikelets elliptic, 2 mm. long;  
culms simple, sometimes  
1 meter or more high;  
sheaths and blades pu-  
bescent..... 36. *P. tenellum*.

Spikelets broadly ovate,  
about 1.5 mm. long;  
culms freely branching.. 21. *P. lentiginosum*.

1. *Paspalum repens* Berg. Act. Helv. Phys.-Math. 7: 129. pl. 7. 1772.

*Ceresia fluitans* Ell. Bot. S. C. & Ga. 1: 109. 1816.

*Paspalum mucronatum* Muhl. Descr. Gram. 96. 1817.

*Paspalum fluitans* Kunth, Rév. Gram. 1: 24. 1829.

Type locality, "in Surinam."

RANGE: Southern United States to South America.

HERBARIUM SPECIMEN FROM MEXICO:

TABASCO: San Juan Bautista, *Rovirosa* 44.

2. *Paspalum longicuspe* Nash, N. Amer. Fl. 17: 172. 1912.

Type locality, "near Guadalajara, Jalisco," the type specimen collected by Pringle (no. 3854).

RANGE: Known only from Jalisco.

HERBARIUM SPECIMENS:

JALISCO: Guadalajara, floating in water, *Pringle* 3854. Orozco, in deeper part  
of large pond, among water lilies, *Hitchcock* 7386.

3. *Paspalum acuminatum* Raddi, Agrost. Bras. 25. 1823.

Type locality, Brazil.

RANGE: Southern Mexico to Paraguay.

HERBARIUM SPECIMEN FROM MEXICO:

MICHOACÁN: Morelia, *Arsène* in 1909.

4. *Paspalum prostratum* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24:  
9. 1900.

*Paspalum prostratum pygmaeum* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost.  
Bull. 24: 9. 1900.

Type locality, "low lands near Patzcuaro, State of Michoacan," the type specimen  
collected by Pringle (no. 3343).



RANGE: Southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

HIDALGO: Trinidad Iron Works, wet soil, *Pringle* 8891.

FEDERAL DISTRICT: Pedregal, *Pringle* 7167.

MICHOACÁN: Pátzcuaro, low lands, *Pringle* 3343. Morelia, *Arsène* in 1909.

5. *Paspalum stellatum* Humb. & Bonpl. in Flügge, Monogr. Pasp. 62. 1810.

Type locality, "America meridionalis."

RANGE: Highlands of southern Mexico to South America.

HERBARIUM SPECIMENS FROM MEXICO:

CHIAPAS: Teopisco, common along water side, *Collins & Doyle* 124. Near Cancuc, *Nelson* 3424.

6. *Paspalum cymbiforme* Fourn. Mex. Pl. 2: 5. 1886.

Type locality, "Mirador, in campis," the type specimen collected by Liebmann (no. 224).

RANGE: Highlands of southern Mexico and Guatemala.

HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Mirador, *Liebmann* 224.

7. *Paspalum humboldtianum* Flügge, Monogr. Pasp. 67. 1810.

Type locality, "America meridionalis."

RANGE: Highlands of central Mexico to South America.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Sierra de Alamos, *Rose, Standley & Russell* 12832.

COAHUILA: Jaral, *Schumann* 1737.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 173. Cárdenas, clay bank along railway, *Hitchcock* 5776; bank of railway cut, *Hitchcock* 5723.

JALISCO: Guadalajara, *Palmer* 286 in 1886; moist ledges of barranca, *Pringle* 1750; moist banks, *Pringle* 11757; prairie, *Hitchcock* 7297. Zapotlán, hills, *Hitchcock* 7176.

COLIMA: Alzada, open hill, *Hitchcock* 7055.

MICHOACÁN: Uruápan, side of open ravine, *Hitchcock* 6980. Morelia, *Arsène* in 1909.

PUEBLA: Mount Orizaba, rocky hills, *Seaton* 117.

VERACRUZ: Orizaba, *Müller* 2037; *Bourgeau* 2641; open rocky hill, *Hitchcock* 6355. Mirador, *Liebmann* 221. Jalapa, railway cut near Coatepec, *Hitchcock* 6679. Zacuapan, dry meadows, *Purpus* 2002; savannas, *Purpus* 2901.

MORELOS: Cuernavaca, rocky ledge, *Hitchcock* 6837; *Rose* 3510; in barranca, *Rose, Painter & Rose* 10203.

OAXACA: Sierra de San Felipe, *Conzatti & González* 440; Oaxaca, rocky hill, *Hitchcock* 6133.

8. *Paspalum vaginatum* Swartz, Prodr. Veg. Ind. Occ. 21. 1788.

Type locality, "Jamaica."

RANGE: Coasts and brackish sands, Florida to Texas, the West Indies, and South America.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandegge* 2 in 1890.

TAMAULIPAS: Tampico, brackish marsh, *Hitchcock* 5785.

SAN LUIS POTOSÍ: Guascama, *Purpus* 5421. Hacienda de Angostura, alkaline meadows, *Pringle* 3695.

PUEBLA: Puebla, roadsides, *Nicolas* in 1908.

VERACRUZ: Veracruz, sandy beach, *Hitchcock* 6568.

9. *Paspalum distichum* L. Syst. Nat. ed. 10. 855. 1759.

Type locality not given, probably Jamaica.



RANGE: Along ditches and in wet places, southern United States to West Indies and South America; also in the Old World.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Agueda, *Palmer* 214 in 1890.

SONORA: Yaqui River, *Palmer* 16 in 1869. Guaymas, *Palmer* 693 in 1887. Hermosillo, along ditch, *Hitchcock* 3575; wet sand, bed of river, *Hitchcock* 3615, 3616.

CHIHUAHUA: Galleana, banks of Río de Galleana, *Hartman* 659. Miñaca, dry run, *Hitchcock* 7735.

DURANGO: Torreón, along ditch, *Hitchcock* 7561. Durango, about ponds and water courses, *Palmer* 192 in 1896; in water of ditch, *Hitchcock* 7568.

COAHUILA: Saltillo, along irrigation ditch, *Hitchcock* 5587, 5588, 5602; wet waste and cultivated ground, *Palmer* 259 and 391 in 1898.

NUEVO LEÓN: Monterrey, rocky river bed, *Hitchcock* 5522; mud bank along river, *Hitchcock* 5552; irrigation ditch, *Hitchcock* 5575.

ZACATECAS: Zacatecas, along dry river bed, *Hitchcock* 7528.

AGUASCALIENTES: Aguascalientes, ditch, *Hitchcock* 7481.

SAN LUIS POTOSÍ: Cárdenas, water of irrigation ditch, *Hitchcock* 5743, 5748. San Luis Potosí, irrigation ditch, *Hitchcock* 5683; *Schaffner* 1071.

JALISCO: Guadalajara, *Palmer* 243 in 1886; ditch on road to Barranca de Oblatos, *Hitchcock* 7311. Orozco, margin of large pond, *Hitchcock* 7378. Zapotlán, railway right of way, *Hitchcock* 7127.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7415. Acámbaro, along ditch, *Hitchcock* 6944.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5837, 5815.

HIDALGO: Pachuca, sandy river bed, *Hitchcock* 6768.

MICHOACÁN: Morelia, *Arsène* in 1909.

MEXICO: Toluca, along ditch, *Hitchcock* 6910. Federal District, along ditch, *Hitchcock* 5884; *Pringle* 6780; *Bourgeau* 532.

PUEBLA: Rancho Posados, *Nicolas* in 1910. Tehuacán, along ditch, *Hitchcock* 6044, 6066. Chalchicomula, along ditch, *Hitchcock* 6291. Mount Orizaba, *Seaton* 61.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6312, 6314. Jalapa, along railway through jungle, *Hitchcock* 6647, 6652. Veracruz, low prairie, *Hitchcock* 6561. Córdoba, weed along track, *Hitchcock* 6400.

MORELOS: Cuernavaca, moist soil, *Hitchcock* 6844.

OAXACA: Between Tule and Oaxaca, in water of ditch, *Hitchcock* 6168, 6173. Tomellín, along ditch, *Hitchcock* 6225.

10. *Paspalum conjugatum* Berg. Act. Helv. Phys.-Math. 7: 129. 1762.

Type locality, "in Surinamo."

RANGE: Tropics and subtropics of both hemispheres.

HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Victoria, *Palmer* 419 in 1907.

SAN LUIS POTOSÍ: Las Canoas, wet soil, *Pringle* 3129.

JALISCO: Tequila, *Palmer* 367 in 1886.

COLIMA: Colima, *Palmer* 1272 in 1891, 16 in 1897. Manzanillo, weed in pasture, *Hitchcock* 7030. Paso del Río, *Emrick* 193.

MICHOACÁN: Coahuayutla, *Emrick* 48.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6318; *Botteri*; *Bourgeau* 2792. Sanborn, *Orcutt* 3248. Córdoba, *Kerber* 49; weed, *Hitchcock* 6407. Jalapa, among shrubs along railway, *Hitchcock* 6609. Mirador, *Liebmann* 160. Zacuapan, open forests, *Purpus* 2158. Pital, *Liebmann* 158.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

MORÉLOS: Cuernavaca, wet banks, *Pringle* 6215; damp place along wall, *Hitchcock* 6818.

OAXACA: Tomellín, *Rose, Painter & Rose* 10050; low woods, *Hitchcock* 6222.

CHIAPAS: Ocuilapa, *Nelson* 3055.

11. *Paspalum orbiculatum* Poir. in Lam. Encycl. Suppl. 5: 32. 1804.

*Paspalum pusillum* Vent. in Flügge, Monogr. Pasp. 100. 1810.

Type locality, "Porto Ricco," the type specimen collected by Ledru.

RANGE: Veracruz and West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Hacienda de Santa Bárbara, *Liebmann* 153. Sanborn, *Orcutt* 3245.

12. *Paspalum clavuliferum* Wright, Anal. Acad. Cienc. Habana 8: 203. 1871.

*Paspalum pittieri* Hack.; Beal, Grasses N. Amer. 2: 88. 1896.

Type locality, Cuba, the type specimen collected by Wright (no. 3444 in part).

RANGE: West Indies and southern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Near Guadalajara, wet places in hills, *Pringle* 2359, 11762.

COLIMA: Alzada, along railway cut, *Hitchcock* 7065.

13. *Paspalum setaceum* Michx. Fl. Bor. Amer. 1: 43. 1803.

Type locality, "in aridis Carolinae inferioris."

RANGE: Middle eastern United States to southern Mexico and the West Indies.

## HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Tampico, sand dunes, *Hitchcock* 5793.

VERACRUZ: Veracruz, *Orcutt* 2891 (a depauperate specimen, doubtfully referred to this species).

14. *Paspalum ciliatifolium* Michx. Fl. Bor. Amer. 1: 44. 1803.

Type locality, "in Carolina."

RANGE: Southeastern United States and the West Indies to southern Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Veracruz, sandy prairie, *Hitchcock* 6549.

15. *Paspalum stramineum* Nash in Britton, Man. 74. 1901.

Type locality given as "In sandy places and fields, Neb., Kans., and Ind. Terr."

RANGE: Middle northern United States to northern Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

SONORA: Nogales to Cocospora Ranch, *Griffiths* 6805.

16. *Paspalum culiacanum* Vasey, Contr. U. S. Nat. Herb. 1: 281. 1893.

Type locality, "in the mountains of Culiacan," the type specimen collected by Palmer (no. 1647) "in large bunches around a water hole."

RANGE: Known only from the type collection.

17. *Paspalum langei* (Fourn.) Nash, N. Amer. Fl. 17: 179. 1912.<sup>1</sup>

*Dimorphostachys langei* Fourn. Mex. Pl. 2: 14. 1886.

*Dimorphostachys drummondii* Fourn. Mex. Pl. 2: 15. 1886.

*Paspalum drummondii* Vasey, Contr. U. S. Nat. Herb. 3: 18. 1892, not Muell. 1861.

*Paspalum oricola* Millsp. & Chase, Field Mus. Bot. 3: 28. 1903.

Type locality, "Hacienda de Jovo," Veracruz, this being the first locality cited.

RANGE: Gulf region of the United States and Mexico.

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<sup>1</sup> This name is tentatively accepted for this species on the authority of Nash, Fournier's description not fully agreeing with our plants and the type of *D. langei* not having been examined.



## HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Monterey, shady rich soil, *Hitchcock* 5562; by wet irrigation ditch, *Hitchcock* 5573.

SAN LUIS POTOSÍ: Las Canóas, fields, *Pringle* 3991.

VERACRUZ: Córdoba, clay cut, *Hitchcock* 6417. Jalapa, *Hitchcock* 6644½.

YUCATÁN: Cozumel, *Millspaugh* 1480.

18. *Paspalum planifolium* Fourn. Mex. Pl. 2: 10. 1886.

*Dimorphostachys botteri* Fourn. Mex. Pl. 2: 14. 1886.

*Dimorphostachys paspaloides* Fourn. Mex. Pl. 2: 14. 1886.

Type locality, "San Luis de Potosi" and "Orizaba" given.

RANGE: San Luis Potosí to Guatemala.

## HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Las Canóas, low fields, *Pringle* 3779; moist grassy ground, *Hitchcock* 5760. Sierra de Guascama, *Purpus* 5423.

JALISCO: Tequila, *Palmer* 144 in 1886.

COLIMA: Alzada, rich wooded hillside, *Hitchcock* 7074.

VERACRUZ: Pital, *Liebmann* 184. Orizaba, open rocky hill, *Hitchcock* 6377; *Seaton*, 112a; *Botteri* 659. Jalapa, open edge of forest, *Hitchcock* 6603. Río Blanco, roadside ditch, *Hitchcock* 6328, 6347. Córdoba, clay cut, *Hitchcock* 6416.

MORELOS: Cuernavaca, along road, *Hitchcock* 6826.

OAXACA: Oaxaca, along streamlet, *Hitchcock* 6153; along ditch between Tule and Oaxaca, *Hitchcock* 6182, 6185. Tomellín, along ditch, *Hitchcock* 6209.

19. *Paspalum variabile* (Fourn.) Nash, N. Amer. Fl. 17: 180. 1912.

*Dimorphostachys schaffneri* Fourn. Mex. Pl. 2: 15. 1886,<sup>1</sup> not *Paspalum schaffneri* Fourn. op. cit. 6.

*Dimorphostachys variabilis* Fourn. Mex. Pl. 2: 15. 1886.<sup>1</sup>

*Paspalum schaffneri* Scribn. in Millsp. Field Mus. Bot. 2: 24. 1900, not Fourn. 1886.

Type locality, Mexico, the type specimen collected by Ghiesbreght being without data.

RANGE: Known only from Veracruz.

## HERBARIUM SPECIMENS:

VERACRUZ: Córdoba, *Bourgeau* 1658; clay cut, *Hitchcock* 6411; under coffee trees, *Hitchcock* 6439. Jalapa, in shrubs along railway, *Hitchcock* 6608; railway cut through jungle, *Hitchcock* 6644, 6645. Orizaba, roadside ditch, *Hitchcock* 6323; *Bourgeau* 2598.

20. *Paspalum squamulatum* Fourn. Mex. Pl. 2: 11. 1886.

Type locality, "In graminosis prope Chinantla," the first specimen cited (agreeing perfectly with the description) being taken as the type.

RANGE: Northern Mexico to Costa Rica.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandegge* 40 in 1899.

SINALOA: Culiacán, moist field, *Rose, Standley & Russell* 14859.

JALISCO: Zapotlán, pine woods, hillside, *Hitchcock* 7246.

MICHOACÁN: Uruápan, in bushes along road, *Hitchcock* 6961; pine woods on hill, *Hitchcock* 6978.

PUEBLA: Chinantla, *Liebmann* 198.

VERACRUZ: Orizaba, shaded rich loam near top of hill, *Hitchcock* 6387; *Bourgeau* 2640. Jalapa, *Smith* in 1894; along railway, *Hitchcock* 6654, 6638.

OAXACA: Totontepec, *Nelson* 727.

<sup>1</sup> The spikelets of the type of *D. variabilis* are smaller than those of the type of *D. schaffneri*; the two forms may prove to be distinct.



**21. *Paspalum lentiginosum* Presl, Rel. Haenk. 1: 218. 1830.**

Type locality, "Mexico."

RANGE: Pacific slope of Mexico.

## HERBARIUM SPECIMENS:

SONORA: Hermosillo, along ditch, *Hitchcock* 3601, 3621.SINALOA: Culiacán, among bushes at edge of marsh, *Palmer* 1556 in 1891.COLIMA: Alzada, prairie, *Hitchcock* 7098. Manzanillo, open place on wooded hillside, *Hitchcock* 7036.MORELOS: Cuernavaca, edge of cut in prairie, *Hitchcock* 6883 (doubtfully referred).A specimen from Mérida, Yucatán, *Schott* 597, with smaller spikelets and simple culm may belong to this species.**22. *Paspalum paniculatum* L. Syst. Nat. ed. 10. 2: 855. 1759.**

Type locality, Jamaica.

RANGE: Mexico and the West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Culiacán, common in wet meadows, *Palmer* 1555 in 1891. Rosario, *Rose* 1543.TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14229. Tepic, moist river bottom, *Palmer* 1924 in 1892.JALISCO: Guadalajara, mesa along ditch, road to Barranca de Oblatos, *Hitchcock* 7316; by streams, *Pringle* 2042.COLIMA: Colima, in rich shady moist places, *Palmer* 18 in 1897, 1265 in 1891.VERACRUZ: Mirador, *Liebmann* 164. Orizaba, *Bourgeau* 2642; roadside ditch, *Hitchcock* 6346; open rocky hill, *Hitchcock* 6374. Córdoba, *Fink* 17½; along river bank, *Hitchcock* 6397. Pital, *Liebmann* 163. Sanborn, *Orcutt* 3246. Coatzacoalcos, *Smith* 1053.MORELOS: Cuernavaca, low prairie, *Hitchcock* 6874; *Rose* 3514.**23. *Paspalum plicatulum* Michx. Fl. Bor. Amer. 1: 45. 1803.**

Type locality given as "in Georgia et Florida."

RANGE: Southern United States and West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Between Rosario and Acaponeta, *Rose* 1885.TEPIC: Pedro Paulo, *Rose* 1961. Acaponeta, *Rose* 3294.SAN LUIS POTOSÍ: Cárdenas, railway cut, *Hitchcock* 5773½. Las Canóas, hillsides, *Pringle* 3772; prairie *Hitchcock* 5764.JALISCO: Guadalajara, *Palmer* 190 and 468 in 1886.COLIMA: Colima, *Palmer* 144 in 1897. Alzada along brook, *Hitchcock* 7057; upland prairie, *Hitchcock* 7059.VERACRUZ: Coatzacoalcos, *Smith* 1054. Córdoba, clay cut, *Hitchcock* 6409, 6414. Mirador, *Liebmann* 182. Zacuapan, *Purpus* 3777. Orizaba, *Botteri; Bourgeau* 2633; open rocky hill, *Hitchcock* 6358, 6371. Jalapa, clay cut, *Hitchcock* 6614.MORELOS: Cuernavaca, rocky soil, *Hitchcock* 6882½; along road, *Hitchcock* 6854.OAXACA: Efígenia, *Nelson* 2853.**24. *Paspalum convexum* Humb. & Bonpl. in Flügge, Monogr. Pasp. 175. 1810.***Paspalum hemicryptum* Wright, Anal. Acad. Cienc. Habana 8: 204. 1871.*Paspalum inops* Vasey, Contr. U. S. Nat. Herb. 1: 281. 1893.*Paspalum inops major* Vasey; Beal, Grasses N. Amer. 2: 89. 1896.Type locality, "in devexis, apricis montis ignivomi Jorullo—(Regno Mexicano)," as given in the Nova Genera.<sup>1</sup>

RANGE: Central Mexico to Costa Rica and in the West Indies.

<sup>1</sup> H. B. K. Nov. Gen. & Sp. 1: 91. 1816.



## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sierra Madre, sandy alluvium of canyons, *Pringle* 1875.

SINALOA: Lodiago, banks of Culiacán River, *Palmer* 1658 in 1891.

DURANGO: Durango, dry ground, *Hitchcock* 7592.

ZACATECAS: Plateado, *Rose*, 2781.

JALISCO: Valencia, along railway, *Hitchcock* 7005. San Nicolás, prairie, *Hitchcock* 7190; cornfield, *Hitchcock* 7221, 7222, 7223. Zapotlán, railway right of way, *Hitchcock* 7120, 7134. Guadalajara, prairie, *Hitchcock* 7284, 7290; plains, *Pringle* 11761; *Palmer* 592 in 1886. La Junta, along railway, *Hitchcock* 6999.

GUANAJUATO: Guanajuato, *Dugès* in 1897.

COLIMA: Alzada, upland prairie, *Hitchcock* 7064.

MICHOACÁN: Uruápan, cornfield on hill, *Hitchcock* 6957; along road, *Hitchcock* 6958; open pasture land, *Hitchcock* 6993, 6994. Morelia, *Arsène* in 1909.

FEDERAL DISTRICT: Lava fields, *Pringle* 6427, 9583.

VERACRUZ: Jalapa, in cinders along railway, *Hitchcock* 6657, 6668.

MORELOS: Cuernavaca, *Orcutt* 3889; pasture, *Hitchcock* 6830; along railway, *Hitchcock* 6863, 6868.

GUERRERO: Santa Fé, along railway, *Hitchcock* 6692.

**25. *Paspalum notatum* Flüggé, Monogr. Pasp. 106. 1810.**

Type locality, "Insula St. Thomae."

RANGE: Central Mexico to West Indies and South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Las Canóas, hills, *Pringle* 3774; open ground, *Hitchcock* 5765. Cárdenas, ditch of railway cut, *Hitchcock* 5727; open grassy ground, *Hitchcock* 5778.

JALISCO: San Nicolás, prairie, *Hitchcock* 7183. Guadalajara, *Rose* 3421; prairie, *Hitchcock* 7281; fields, *Pringle* 11240; *Palmer* 295 in 1886. Zapotlán, railway right of way, *Hitchcock* 7141. La Junta, along track, *Hitchcock* 6996.

COLIMA: Colima, *Palmer* 138 in 1897.

MICHOACÁN: Uruápan, prairie, *Hitchcock* 6984.

PUEBLA: Mount Orizaba, *Seaton* 112B.

VERACRUZ: Orizaba, *Bourgeau* 2749; roadside ditch, *Hitchcock* 6322. Córdoba, common roadside weed, *Hitchcock* 6430. Veracruz, sandy prairie, *Hitchcock* 6565; along harbor front, *Hitchcock* 6577. Jalapa, clay cut, *Hitchcock* 6591.

MORELOS: Cuernavaca, pasture, *Hitchcock* 6838.

OAXACA: Las Sedas, *Smith* 933. Valley of Oaxaca, *Conzatti & González* 341; *Nelson* 1262. Oaxaca, open ground along road, *Hitchcock* 6109. Tomellín, along ditch, *Hitchcock* 6245.

CHIAPAS: Ocuilapa, table-land, *Nelson* 3033.

**26. *Paspalum minus* Fourn. Mex. Pl. 2: 6. 1886.**

Type locality, "In valle Cordovensi," the locality of the first specimen cited.

RANGE: Southern Mexico and West Indies south to Uruguay.

## HERBARIUM SPECIMENS FROM MEXICO:

MICHOACÁN: Uruápan, along road, *Hitchcock* 6962.

VERACRUZ: Mecapalco, *Liebmann* 156. Córdoba, valley, *Bourgeau* 2298. Jalapa, clay cut, *Hitchcock* 6590.

**27. *Paspalum glaberrimum* Nash in Small, Fl. Southeast. U. S. 76. 1903.**

Type locality, "southern peninsular Florida," the type specimen collected in the vicinity of Eustis, by Nash (no. 1619).

RANGE: Gulf Coast of the United States and in Colima.

## HERBARIUM SPECIMEN FROM MEXICO:

COLIMA: Alzada, prairie, *Hitchcock* 7078.



**28. *Paspalum crinitum* Chase, sp. nov.**

Perennial, cespitose, leafy at the base; culms erect, slender, simple, 0.75 to 1 meter high, glabrous; sheaths mostly overlapping, the lower crowded, clothed with long gray hairs, the others densely and finely pubescent, the uppermost sometimes sparsely appressed-pubescent; ligule membranaceous, about 5 mm. long, nearly entire, rather firm; blades flat, stiffly ascending, densely and finely pubescent on both surfaces, 10 to 25 cm. long, 4 to 7 mm. wide, the lower shorter, in age disarticulating from the sheath, the uppermost reduced to a point of the elongated sheath; panicle 10 to 20 cm. long, the axis slender, usually bearing a tuft of long white hairs in the axils of the racemes, otherwise glabrous; racemes 6 to 10, slender, finally spreading, distant, rarely approximate, the lower as much as 12 cm. long, occasionally compound; rachis slender, dark purple, bearing a few scattered hairs along the angles or glabrous; spikelets in pairs, loosely imbricated, or at the very base scattered (the slender dark pedicels of the upper of the pair about 1 mm. long), light yellowish green or purple-tinged, 2.6 to 2.8 mm. long, 1.3 mm. wide, elliptic, depressed-convex on the back; second glume and sterile lemma thin, equal, covering the fruit, 3-nerved, sparsely pilose with delicate hairs or glabrous; fruit pale, minutely papillose.

Type in the U. S. National Herbarium, no. 824361, collected in alkaline meadows, Hacienda de Angostura, State of San Luis Potosí, Mexico, July 10, 1891, by C. G. Pringle (no. 3755) and distributed as "*Paspalum tenellum* Willd.?"

The spikelets of this species indicate affinity to *P. lividum*, but the habit is so different that it would seem to be but distantly allied to it.

RANGE: Highlands, San Luis Potosí and Puebla.

## HERBARIUM SPECIMENS:

SAN LUIS POTOSÍ: Hacienda de Angostura, *Pringle* 3755.

PUEBLA: Without locality, *Nicolas* in 1909.

**29. *Paspalum lividum* Trin.; Scheele, *Linnaea* 26: 383. 1854.**

Type locality, "Ad Hacienda de la Laguna," Veracruz, the type specimen collected by Schiede.

RANGE: Southern United States and the West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Culiacán, swampy places, *Palmer* 1552 in 1891; *Brandeggee* in 1904.

COAHUILA: Saltillo, *Palmer* 338 in 1904.

NUEVO LEÓN: Monterey, wet places, *Pringle* 2516; along irrigation ditch, *Hitchcock* 5565.

SAN LUIS POTOSÍ: Cárdenas, in water of irrigation ditch, forming runners, *Hitchcock* 5740.

JALISCO: Tequila, *Palmer* 206 in 1886. Guadalajara, *Palmer* 245 in 1886; mesa along ditch, road to Barranca de Oblatos, *Hitchcock* 7318. San Nicolás, prairie, *Hitchcock* 7182, 7197. Zapotlán, prairie along railway, *Hitchcock* 7147. Orozco, near large pond, *Hitchcock* 7382.

GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6933. Irapuato, moist sandy-clay plain, *Hitchcock* 7388, 7404, 7409.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5817, 5869.

HIDALGO: Ixmiquilpan, river banks, *Rose, Painter & Rose* 9059.

MICHOACÁN: Uruápan, low ground along railway, *Hitchcock* 6992. Morelia, *Arsène* in 1909.

PUEBLA: Mount Orizaba, *Seaton* 62.

VERACRUZ: Orizaba, *Bourgeau* 2544; *Botteri* 110, 1286; *Müller* 2061; roadside ditch, *Hitchcock* 6313. Tlacotalpan, *Nelson* 523. Córdoba, weed in field, *Hitchcock* 6451. Jalapa, along railway, *Hitchcock* 6620.

MORELOS: Cuernavaca, hillside pasture, *Hitchcock* 6823; along railway, *Hitchcock* 6880, 6881.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

OAXACA: Oaxaca, low ground near river, *Hitchcock* 6152. Valley of Oaxaca, *Conzatti & González* 349. Santa Catarina Canyon, *Pringle & Conzatti* 272. Tomellín, along ditch, *Hitchcock* 6208.

**30. *Paspalum buckleyanum* Vasey, Bull. Torrey Club 13: 167. 1886.**

Type locality, "Texas," the type specimen collected by Buckley.

RANGE: Texas to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Hermosillo, along ditch, *Hitchcock* 3622.

NUEVO LEÓN: Monterey, along irrigation ditch, *Hitchcock* 5564.

SAN LUIS POTOSÍ: Cárdenas, water of irrigation ditch, *Hitchcock* 5743½, 5748½; Hacienda de Angostura, alkaline meadows, *Pringle* 3764.

JALISCO: Chapala, *Rose* 3437; San Nicolás, prairie, *Hitchcock* 7181.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7400. Acámbaro, along ditch, *Hitchcock* 6938.

MICHOACÁN: Valley of Zamora, in water, *Pringle* 9599, 9600.

MORELOS: Cuernavaca, rocky soil along railway, *Hitchcock* 6879, 6882.

OAXACA: Oaxaca, open ground along railway, *Hitchcock* 6130. Between Tule and Oaxaca, along ditch, *Hitchcock* 6177, 6189, 6190.

**31. *Paspalum pubiflorum* Rupr.; Fourn. Mex. Pl. 2: 11. 1886.**

*Paspalum hallii* Vasey & Scribn. Bull. Torrey Club 13: 165. 1886.

*Paspalum paucispicatum* Vasey, Contr. U. S. Nat. Herb. 1: 281. 1893.

Type locality, "Secus rivulos inter Cactos, Tehuacan de las Granadas," the type specimen collected by Galeotti (no. 5747).

RANGE: Southwestern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Hermosillo, along ditch, *Hitchcock* 3600, 3623.

CHIHUAHUA: Chihuahua, by streams, *Pringle* 3741; *Kurtz* in 1885.

DURANGO: Durango, along water ditch in a wet meadow, *Palmer* 871 in 1896; near pond, *Hitchcock* 7578.

COAHUILA: Jimulco Springs, *Pringle* 427. Sabinas, *Nelson* 6832. Saltillo, along irrigation ditch, *Hitchcock* 5590, 5608.

NUEVO LEÓN: Monterey, irrigation ditch, *Hitchcock* 5549, 5555, 5563, 5572.

TAMAULIPAS: Victoria, *Palmer* 261 and 395 in 1907.

SAN LUIS POTOSÍ: Cárdenas, by railway, *Hitchcock* 5735.

JALISCO: Colotlán, *Rose* 3602. San Nicolás, prairie, *Hitchcock* 7196; cornfield, *Hitchcock* 7220; weed in field, *Hitchcock* 7229, 7230. Guadalajara, *Palmer* 243 in 1886.

GUANAJUATO: Acámbaro, along road, *Hitchcock* 6948; along ditch, *Hitchcock* 6950. Irapuato, moist sandy-clay plain, *Hitchcock* 7414.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5811.

MICHOACÁN: Loma Santa María, near Morelia, *Arsène* in 1909.

PUEBLA: Tehuacán, *Seler* 5; along railway ditch, *Hitchcock* 6059.

MORELOS: Yautepec, on pedregal, *Rose, Painter & Rose* 8555.

GUERRERO: Santa Fé, along railway, *Hitchcock* 6686.

OAXACA: Between Tule and Oaxaca, *Hitchcock* 6188. Valley of Oaxaca, *Conzatti & González* 350.

**32. *Paspalum fasciculatum* Willd. in Flüge, Monogr. Pasp. 69. 1810.**

Type locality, "Brasilia."

RANGE: Southern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Córdoba, "lower portion of culms creeping, forming tangled mass," low ground, *Hitchcock* 6428.

TABASCO: San Juan Bautista, river banks, *Rovirosa* 260 in 1888.



**33. *Paspalum virgatum* L. Syst. Nat. ed. 10. 855. 1759.**

Type locality, Jamaica, the type specimen sent by Browne.

RANGE: Southern Mexico and West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7363.

VERACRUZ: Córdoba, clay cut, *Hitchcock* 6413; low ground along railway, *Hitchcock* 6434; *Fink* 7. Jalapa, railway cut through jungle, *Hitchcock* 6643. Between Coatepec and Jalapa, *Hitchcock* 6684. Orizaba, *Bourgeau* 2979, *Botteri* 1267. Zacuapan, brush woods, *Purpus* 2906. Monte Pacho, *Liebmann* 173.

CHIAPAS: Ocuilapa, table-land, *Nelson* 3035.

**34. *Paspalum conspersum* Schrad. in Schult. Mant. 2: 174. 1817.**

Type locality, "In Brasilia."

RANGE: Southern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Mirador, *Liebmann* 169. Jalapa, along railway in high vegetation, *Hitchcock* 6613, 6617. Orizaba, in humid grassy places, *Botteri* in October, 1857.

CHIAPAS: Ocuilapa, table-land, *Nelson* 3047.

**35. *Paspalum crassum* Chase, sp. nov.**

A large coarse annual producing prop roots from the lower nodes; culms stout, erect, about 2 meters high, simple or sparingly branching from the lower nodes, papillose-hispid below the nodes and toward the summit; sheaths loose, longer than the internodes, coarsely papillose-hispid; ligule membranaceous, about 5 mm. long, lacerate; blades as much as 60 cm. long and 3 cm. wide, tapering to the base, conspicuously papillose-hispid on both surfaces, the midnerve prominent beneath; panicle about 20 cm. long, the axis strongly angled; racemes about 10, narrowly ascending, more or less arching above, the rachis about 3 mm. wide, scabrous, pilose in the axils; spikelets mostly solitary (the lower of the pair undeveloped), imbricated but scarcely crowded, pale green, 3.1 mm. long, 1.7 mm. wide, oval, turgid, slightly concave on the face, blunt, glabrous, the second glume and sterile lemma subchartaceous, covering the fruit, the first glume minute or obsolete, firm, the sterile lemma inclosing a hyaline palea and a more or less developed staminate flower; fruit minutely papillose-striate, the margin of the lemma thin.

Type in the U. S. National Herbarium, no. 691235, collected "in prairie, among high grass and weeds, 450 meters altitude, at Alzada, Colima, Mexico, September 21, 1910," by A. S. Hitchcock (no. 7093).

This striking species, known only from the type collection, is not closely related to any known species. Its coarse, hispid foliage and thick prop roots produce a resemblance in habit to *Echinochloa walteri*.

**36. *Paspalum tenellum* Willd. Enum. Hort. Berol. 89. 1809.**

Type locality, "Hort. paris," the native country unknown.

RANGE: Highlands of southern Mexico.

## HERBARIUM SPECIMENS:

These plants, doubtfully referred here, agree with Willdenow's inadequate description and appear to belong to the species referred to *P. tenellum* by Fournier<sup>1</sup> and by Nash.<sup>2</sup>

JALISCO: Zapotlán, prairie, *Hitchcock* 7121, 7133. San Nicolás, sterile clay hill, *Hitchcock* 7208. Guadalajara, fields, *Pringle* 11239.

MICHOACÁN: Maravatio, along ditch, *Hitchcock* 6922.

FEDERAL DISTRICT: Lava beds, *Pringle* 6474; clefts and depressions in lava rock, *Hitchcock* 5955; *Holway* 3065.

<sup>1</sup> Mex. Pl. 2: 11. 1886.

<sup>2</sup> N. Amer. Fl. 17: 185. 1912.



**37. *Paspalum jaliscanum* Chase, sp. nov.**

Culms simple, slender, 1 meter or more high, solitary, ascending or erect from a stout rootstock bearing densely harsh-pubescent scales; nodes appressed-hirsute or the upper nearly glabrous; sheaths sparsely papillose-hirsute along the margin and toward the summit; ligule membranaceous, brown, 3 mm. long, a ring of long white hairs at the base of the blade surrounding it; blades flat, 12 to 20 cm. long, 12 to 15 mm. wide (the elongated upper sheath bladeless or nearly so), tapering to the base, or those of the mid-culm rounded at base, dull green above, glossy beneath, pilose at the base on the upper surface, the margin inconspicuously stiffly ciliate; panicle long-exserted, brownish purple, 8 to 10 cm. long, the main axis slender but stiff; racemes 5 to 12, ascending or spreading, the lower (sometimes branching) 4 to 5 cm. long, the others gradually shorter, more or less crowded, the rachis slender (about 0.6 mm. wide) a tuft of stiff white hairs in the axil, the axis and rachises otherwise glabrous; spikelets in pairs on glabrous pedicels, 2.2 mm. long, 1.3 mm. wide, elliptical, subacute, strongly convex on the back, slightly concave on the face, the second glume scarcely equaling the fruit, 3-nerved, glandular-pubescent, the sterile lemma equaling the fruit, 3-nerved, glabrous; fruit elliptic, stramineous, smooth and shining.

Type in the U. S. National Herbarium, no. 691236, collected in the lower forest region, at about 2,300 meters altitude, Zapotlán to Nevado de Colima, Jalisco, Mexico, September 23, 1910, by A. S. Hitchcock (no. 7153).

RANGE: Known only from Jalisco, a second collection made in pine woods, hillside, Zapotlán, *Hitchcock* 7240. A specimen lacking the base, with larger panicle and pubescent sterile lemma (*Liebmann* 199, Chinantla, Puebla) may belong to this species.

**38. *Paspalum unispicatum* (Scribn. & Merr.) Nash, N. Amer. Fl. 17: 193. 1912.**

*Panicum unispicatum* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 14. 1901.

Type locality, "Valley of Oaxaca," the type specimen collected by Pringle (no. 6717).

RANGE: Highlands, Nuevo León to Oaxaca.

**HERBARIUM SPECIMENS:**

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5561.

PUEBLA: Acatzinco, *Nicolas* in 1909.

OAXACA: Oaxaca, along hedge in town, *Hitchcock* 6098, 6099; Valley of Oaxaca, *Pringle* 6717.

**39. *Paspalum erianthum* Nees in Trin. Gram. Pan. 121. 1826.**

Type locality, "Brasil."

RANGE: Southern Mexico to South America.

**HERBARIUM SPECIMEN FROM MEXICO.**

OAXACA: Vicinity of San Juan Guichicovi, *Nelson* 2735.

**40. *Paspalum malacophyllum* Trin. Gram. Icon. 3: pl. 271. 1836.**

Type locality, Brazil, the type specimen collected by Langsdorf at "Cuyaba, Chapada" according to the data on the specimen in the Trinius Herbarium.

RANGE: Yucatán to Paraguay.

**HERBARIUM SPECIMEN FROM MEXICO:**

YUCATÁN: Mérida, *Schott* 593.



35. *PANICUM* L. Sp. Pl. 55. 1753.

## KEY TO THE SPECIES.

- Axis of branchlets extending as a bristle beyond the base of the uppermost spikelet..... 1. *P. ramisetum*.
- Axis of branchlets not extending into a bristle.
- Plants annual.
- Inflorescence consisting of several more or less secund spike-like racemes.
- Spikelets 5 to 6 mm. long..... 9. *P. texanum*.
- Spikelets 2 to 4 mm. long.
- Spikelets strongly reticulate-veined, glabrous.
- Panicle branches long and spreading..... 6. *P. fasciculatum*.
- Panicle branches short, appressed.. 6a. *P. fasciculatum chartaginense*.
- Spikelets scarcely reticulate-veined, or near apex only.
- Spikelets not over 2 mm. long, glabrous..... 5. *P. reptans*.
- Spikelets over 3 mm. long, pubescent.
- Plants velvety; sheaths not papillose..... 7. *P. molle*.
- Plants not velvety; sheaths papillose..... 8. *P. arizonicum*.
- Inflorescence a more or less diffuse panicle.
- Spikelets 1.2 to 1.4 mm. long, pubescent; blades more than one-fourth as wide as long..... 39. *P. trichoides*.
- Spikelets 1.7 mm. or more long, glabrous.
- First glume not over one-fourth the length of the spikelet, blunt or triangular-tipped; spikelets on short appressed pedicels..... 10. *P. vaseyanum*.
- First glume usually as much as half the length of the spikelet, acute, or acuminate; spikelets on slender, usually spreading pedicels.
- Panicles more or less drooping..... 15. *P. sonorum*.
- Panicles erect.
- First glume about one-third the length of the spikelet, subacute or blunt..... 14. *P. stramineum*.
- First glume more than half the length of the spikelet, acuminate.
- Spikelets 4.5 to 6 mm. long.
- Spikelets 6 mm. long, scattered..... 16. *P. parcum*.
- Spikelets scarcely over 5 mm. long, approximate..... 13. *P. decolorans*.



Spikelets not over 4 mm.  
long.

First glume more than  
three-fourths the  
length of the  
spikelets, these 4  
mm. long, green  
or pale..... 12. *P. pampinosum*.

First glume half to two-  
thirds the length  
of the spikelets,  
these not over  
3.3 mm. long,  
commonly red-  
dish brown..... 11. *P. hirticaule*.

Plants perennial.

Spikelets short-pediceled along one side of the ra-  
chises, forming spike-like racemes.

First glume nearly as long as the glabrous ob-  
tuse spikelets..... 55. *P. obtusum*.

First glume much shorter than the spikelets.

Spikelets hispid and with two crateri-  
form glands on the sterile lemma.

Spikelets not over 2 mm. long;  
blades not over 4 cm. long... 34. *P. pulchellum*.

Spikelets 3.6 mm. long; blades 4 to  
10 cm. long..... 35. *P. biglandulare*.

Spikelets glabrous.

Blades lanceolate; glumes strongly  
carinate..... 33. *P. frondescens*.

Blades linear, often elongated;  
glumes not carinate.

Spikelets not over 1.5 mm. long.

Spikelets pointed, not ex-  
panded at maturity by  
an enlarged sterile  
palea..... 29. *P. polygonatum*.

Spikelets blunt, expanded  
at maturity by the en-  
larged sterile palea.

Rachis bearing slender  
bristles; nodes vil-  
lous..... 30. *P. pilosum*.

Rachis without bristles;  
nodes glabrous..... 31. *P. laxum*.

Spikelets 2.5 mm. or more long.

Fruit smooth; axis slender,  
pilose..... 28. *P. longum*.

Fruit transversely rugose;  
axis flattened, gla-  
brous.

Nodes bearded..... 4. *P. barbinode*.



Nodes glabrous.

Spikelets 3 mm. long;  
glumes and sterile  
lemma papery.... 3. *P. paludivagum*.

Spikelets not over 2.4  
mm. long; glumes  
and sterile lemma  
not papery..... 2. *P. geminatum*.

Spikelets in open or sometimes in contracted or  
congested panicles, but not in spike-like  
racemes.

Basal leaves usually distinctly different from  
those of the culm, forming a winter rosette;  
culms at first simple, the spikelets of the  
primary panicle not perfecting seed, later  
usually becoming much branched, the  
small secondary panicles with cleistoga-  
mous, fruitful spikelets.

Spikelets glabrous, minute; culms and  
blades pilose..... 45. *P. strigosum*.

Spikelets pubescent.

Spikelets 2.8 mm. or more long.

Sheaths pubescent; spikelets 4 mm.  
long, attenuate at base..... 51. *P. nodatum*.

Sheaths glabrous or minutely puberu-  
lent only.

Blades lanceolate, usually unsym-  
metrically falcate..... 53. *P. joorii*.

Blades linear or nearly so..... 54. *P. albomaculatum*.

Spikelets not over 2.4 mm. long.

Blades stiff, conspicuously striate, taper-  
ing from base to apex; spikelets  
pustulose-pubescent, 2.1 to 2.2 mm.  
long, obtuse..... 46. *P. ovinum*.

Blades not stiff and conspicuously stri-  
ate, linear, or lanceolate.

Sheaths retrorsely pilose; blades soft  
and lax..... 44. *P. xalapense*.

Sheaths not retrorsely pilose.

Spikelets abruptly pointed; blades  
cordate..... 52. *P. viscidellum*.

Spikelets not pointed at maturity;  
blades not cordate.

Plants glabrous as a whole, or the  
nodes and lower sheaths  
only pubescent.

Nodes villous-bearded; spike-  
lets elliptic..... 47. *P. multirameum*.

Nodes glabrous; spikelets spher-  
ical ..... 50. *P. sphaerocarpon*.

Plants conspicuously pubescent  
as a whole.

Plants grayish green, velvety;  
spikelets 1.9 to 2 mm. long. 48. *P. olivaceum*.



- Plants not grayish nor velvety;  
 spikelets 2.2 to 2.4 mm.  
 long..... 49. *P. pseudopubescens*.
- Basal leaves similar to culm leaves, not forming a winter rosette; spikelets all fertile.  
 Fruit transversely rugose.  
 Culms with a corm-like base.  
 Blades mostly over 5 mm. wide; culms more than 1 meter high..... 24. *P. bulbosum*.  
 Blades less than 5 mm. wide; culms rarely as much as 1 meter high.... 24a. *P. bulbosum sciaphilum*.
- Culms from a strong rootstock, not corm-like at base.  
 Nodes hirsute; ligules 4 to 6 mm. long; fruit strongly rugose..... 22. *P. maximum*.  
 Nodes glabrous; ligules 2 mm. long; fruit very obscurely rugose..... 23. *P. plenum*.
- Fruit not transversely rugose (minutely papillose-roughened in *P. millegrana*).  
 First glume very small, not over one-fourth the length of the small obovate blunt spikelet.  
 Blades 12 to 16 cm. long, 2 to 3 cm. wide; fruit glabrous..... 38. *P. parviglume*.  
 Blades not over 10 cm. long nor 1.8 cm. wide; fruit with scattered silky hairs.  
 Blades scabrous on the upper surface, not falcate..... 36. *P. virgultorum*.  
 Blades sparsely hispid on the upper surface, falcate..... 37. *P. schmitzii*.
- First glume as much as one-third the length of the spikelet (less in *P. trichanthum* with pointed spikelets).  
 Spikelets papillose-hispid, obovate, obtuse..... 41. *P. millegrana*.
- Spikelets glabrous.  
 Sterile paleas enlarged and indurated at maturity, expanding the crowded spikelets; blades scarcely wider than their sheaths..... 32. *P. cupreum*.  
 Sterile palea, if present, not enlarged and indurated.  
 Culms arising from a decumbent or creeping base, but not forming scaly rootstocks.  
 Spikelets 5.5 to 6 mm. long; fruit crested at the apex ..... 56. *P. zizanioides*.  
 Spikelets not over 3 mm. long; fruit not crested.  
 Spikelets pointed, not over 1.4 mm. long..... 40. *P. trichanthum*.



- Spikelets obtuse, 2 mm. or more long.
- First glume nearly as long as the spikelet..... 42. *P. glutinosum*.
- First glume about half as long as the spikelet..... 41. *P. millegrana*.
- Culms not creeping at base.
- Plants forming conspicuous scaly rootstocks.
- Spikelets not over 2.4 mm. long; culms rarely over 30 cm. high..... 25. *P. gouini*.
- Spikelets 3.5 mm. or more long; culms 1 meter or more high.
- Spikelets 6 to 8 mm. long; culms decumbent at base..... 27. *P. havardii*.
- Spikelets 4 to 5 mm. long; culms erect..... 26. *P. virgatum*.
- Plants not forming scaly rootstocks.
- Panicles 40 to 60 cm. long, the numerous elongated branches in verticils..... 43. *P. megiston*.
- Panicles not over 35 cm. long, usually much less, the branches not in verticils.
- Second glume and sterile lemma elongated, at least 3 times as long as the fruit..... 17. *P. capillarioides*.
- Second glume and sterile lemma not elongated.
- Blades 2 cm. or more wide.. 21. *P. hirsutum*.
- Blades not over 1 cm. wide.
- Spikelets 4 to 4.2 mm. long, the midnerves of the glumes and sterile lemma scabrous toward the apex..... 19. *P. lepidulum*.
- Spikelets usually less than 3.5 mm. long.
- Blades hirsute on both surfaces (sometimes glabrescent) not at all glaucous..... 20. *P. ghiesbreghtii*.
- Blades glabrous on both surfaces or with a few hairs on either surface, glaucous above... 18. *P. hallii*.



Subgenus **PAUROCHAETIUM** Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 42. 1910.

1. **Panicum ramisetum** Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 27: 9. 1900.  
Type locality, "Texas."

RANGE: Southern Texas and northern Mexico.<sup>1</sup>

**TRUE PANICUM.**

2. **Panicum geminatum** Forsk. Fl. Aegypt. Arab. 18. 1775.

Type locality, "Rosettae in pratis ad littora Nili."

RANGE: Southern United States to South America; also in warmer parts of the Old World.

3. **Panicum paludivagum** Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 32. f. 13. 1910.

Type locality, "'in water,' vicinity of Eustis, Lake County, Florida."

RANGE: Southern United States to Central America.

4. **Panicum barbinode** Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 1: 256. 1834.

PARA GRASS.

Type locality, Bahia, Brazil.

RANGE: Tropics and subtropics of America; escaped from cultivation in North America.

5. **Panicum reptans** L. Syst. Nat. ed. 10. 870. 1759.

Type locality, Jamaica.

RANGE: Tropics and subtropics of both hemispheres.

6. **Panicum fasciculatum** Swartz, Prodr. Veg. Ind. Occ. 22. 1788.

Type locality, "Jamaica."

RANGE: Southern United States to South America.

- 6a. **Panicum fasciculatum chartaginense** (Swartz) Doell in Mart. Fl. Bras. 2<sup>2</sup>: 205. 1877.

Type locality, "America meridionalis, Chartagena," Venezuela.

RANGE: Southwestern United States to South America.

7. **Panicum molle** Swartz, Prodr. Veg. Ind. Occ. 22. 1788.

Type locality, "India occidentalis."

RANGE: Mexico to South America.

8. **Panicum arizonicum** Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 32: 2. 1901.

Type locality, "Mesas near Camp Lowell, Santa Cruz Valley, Arizona, 465 C. G. Pringle, 1881."

RANGE: Southwestern United States to Mexico.

9. **Panicum texanum** Buckl. Prel. Rep. Geol. Agr. Surv. Tex. App. 3. 1866.

COLORADO GRASS.

Type locality, "Austin, Texas."

RANGE: Texas and northern Mexico.

10. **Panicum vaseyanum** Scribn.; Beal, Grasses N. Amer. 2: 140. 1896.

Type locality, wet places, pine plains, base of Sierra Madre, Chihuahua. "Mexico, Pringle 1415."

RANGE: Chihuahua to Jalisco.

<sup>1</sup> The citation of specimens has been given in a recent revision of the genus *Panicum* (Contr. U. S. Nat. Herb. 15. 1910). It is proposed to publish at an early date a supplement to this revision which shall include all the subsequent collections of this genus in the U. S. National Herbarium from North America south of the United States. For these reasons it seems desirable to omit from the present paper the detailed citation of specimens under this genus.



11. *Panicum hirticaule* Presl, Rel. Haenk. 1: 308. 1830.

Type locality, "Acapulco, Mexico."

RANGE: Southwestern United States to southern Mexico.

12. *Panicum pampinosum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 66. f. 48. 1910.

Type locality, "range reserve, altitude 2,600 feet, Wilmot, Arizona."

RANGE: Arizona and New Mexico to central Mexico.

13. *Panicum decolorans* H. B. K. Nov. Gen. & Sp. 1: 100. 1816.

Type locality, "in temperatis, apricis regni Mexicani prope Queretaro."

RANGE: San Luis Potosí to Puebla.

14. *Panicum stramineum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 67. f. 50. 1910.

Type locality, "Guaymas, Sonora, Mexico."

RANGE: Western Mexico.

15. *Panicum sonorum* Beal, Grasses N. Amer. 2: 130. 1896.

Type locality, Lerdo, at the head of the Gulf of California, Sonora, Mexico.

RANGE: Northwestern Mexico.

16. *Panicum parcum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 68. f. 53. 1910.

Type locality, "mountain side, \* \* \* Lodiago, on the Culiacan River, Sinaloa, Mexico."

RANGE: Pacific slope, Sinaloa to Guerrero.

17. *Panicum capillarioides* Vasey in Coulter, Contr. U. S. Nat. Herb. 1: 54. 1890.

Type locality, "Point Isabel" in the region of the Rio Grande, Texas.

RANGE: Southern Texas and northern Mexico.

18. *Panicum hallii* Vasey, Bull. Torrey Club 11: 64. 1884.

Type locality, dry hills, Austin, Texas.

RANGE: Arizona to Texas and central eastern Mexico.

19. *Panicum lepidulum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 75. f. 64. 1910.

Type locality, "by streams, rocky hills near Chihuahua, State of Chihuahua, Mexico."

RANGE: Chihuahua to Jalisco and Puebla.

20. *Panicum ghiesbreghtii* Fourn. Mex. Pl. 2: 29. 1886.<sup>1</sup>

Type locality, Mexico, the particular locality unknown to the author.

RANGE: Central to southern Mexico.

21. *Panicum hirsutum* Swartz, Fl. Ind. Occ. 1: 173. 1797.

Type locality, "Jamaica."

RANGE: Mexico, Central America, and West Indies.

22. *Panicum maximum* Jacq. Coll. Bot. 1: 76. 1786.

GUINEA GRASS.

Type locality, "In insula Guadeloupe."

RANGE: Cultivated and escaped throughout the tropics and subtropics of both hemispheres.

23. *Panicum plenum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 80. f. 69. 1910.

Type locality, "Mangas Springs, 18 miles northwest of Silver City, Grant County, New Mexico."

RANGE: Southwestern United States to southern Mexico.

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<sup>1</sup> See footnote, p. 181.



**24. *Panicum bulbosum*** H. B. K. Nov. Gen. & Sp. 1: 99. 1816.

Type locality, "Novae Hispaniae. . . juxta Santa Rosa, Los Joares et Guanajuato."

RANGE: Mountains of Arizona and New Mexico to southern Mexico.

**24a. *Panicum bulbosum sciaphilum*** (Rupr.) Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 83. 1910.

Type locality, "Sierra de Yavesia," Michoacán.

RANGE: With the species.

**25. *Panicum gouini*** Fourn. Mex. Pl. 2: 28. 1886.

Type locality, "Vera Cruz."

RANGE: Gulf coast of the United States and Mexico; also coast of Uruguay.

**26. *Panicum virgatum*** L. Sp. Pl. 59. 1753.

Type locality, "Virginia."

RANGE: Northern United States to Central America.

**27. *Panicum havardii*** Vasey, Bull. Torrey Club 13: 26. 1886.

Type locality, "Guadalupe Mountains, Texas."

RANGE: Western Texas, New Mexico, and northern Mexico.

**28. *Panicum longum*** Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 111. *f.* 106. 1910.

Type locality, "Swamps near Jalapa, State of Vera Cruz, altitude 1,230 m."

RANGE: Known only from Jalapa.

**29. *Panicum polygonatum*** Schrad. in Schult. Mant. 2: 256. 1824.

Type locality, "In Brasilia, ad ripas fluvii Ilhéos."

RANGE: Veracruz to Paraguay.

**30. *Panicum pilosum*** Swartz, Prodr. Veg. Ind. Occ. 22. 1788.

Type locality, "Jamaica."

RANGE: Mexico, West Indies, south to Brazil.

**31. *Panicum laxum*** Swartz, Prodr. Veg. Ind. Occ. 23. 1788.

Type locality, "Jamaica."

RANGE: Mexico, West Indies, and south to Paraguay.

**32. *Panicum cupreum*** Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 120. *f.* 113. 1910.

Type locality, "Wet hollows in prairies of Flor de Maria, State of Mexico."

RANGE: Known only from the type collection.

**33. *Panicum frondescens*** Meyer, Prim. Fl. Esseq. 56. 1818.

Type locality, "In graminosis insulae Arouabisch," British Guiana.

RANGE: Southern Mexico to South America.

**34. *Panicum pulchellum*** Raddi, Agrost. Bras. 42. 1823.

Type locality, "In sylvaticis prope Catumby \* \* \* ab Urbe Rio Janeiro."

RANGE: Veracruz to South America.

**35. *Panicum biglandulare*** Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 13. *pl.* 14. 1897.

Type locality, "Near Pinabete, Chiapas."

RANGE: Southern Mexico and Guatemala.

**36. *Panicum virgultorum*** Hack. Oesterr. Bot. Zeitschr. 51: 369. 1901.

Type locality, "Costarica: in virgultis ad La Verbena prope Alajuelito."

RANGE: Veracruz to Panama.



37. *Panicum schmitzii* Hack. Ann. Naturhist. Hofm. Wien 17: 254. 1902.

Type locality, Mexico.

RANGE: San Luis Potosí and Veracruz to Central America.

38. *Panicum parviglume* Hack. Oesterr. Bot. Zeitschr. 51: 429. 1901.

Type locality, "Costarica: in ripis fl. Rio Torres prope S. José."

RANGE: Southern Mexico to Costa Rica.

39. *Panicum trichoides* Swartz, Prodr. Veg. Ind. Occ. 24. 1788.

Type locality, "Jamaica."

RANGE: Mexico and West Indies to South America.

40. *Panicum trichanthum* Nees, Agrost. Bras. 210. 1829.

Type locality, Mexico.

RANGE: Mexico and West Indies to Paraguay.

41. *Panicum millegrana* Poir. in Lam. Encycl. Suppl. 4: 278. 1816.

Type locality, "Amérique méridionale."

RANGE: Mexico and Cuba, south to Brazil.

42. *Panicum glutinosum* Swartz, Prodr. Veg. Ind. Occ. 24. 1788.

Type locality, "Jamaica."

RANGE: Mexico and West Indies to South America.

43. *Panicum megiston* Schult. Mant. 2: 248. 1824.

Type locality, "In sylvis humidis plantationis Hof van Holland," British Guiana.

RANGE: Mexico and Cuba to Paraguay.

Subgenus *DICHANTHELIUM* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 42. 1910.

44. *Panicum xalapense* H. B. K. Nov. Gen. & Sp. 1: 103. 1816.

Type locality, "In regno Mexicano prope Xalapa."

RANGE: Middle eastern United States to Veracruz and Hidalgo.

45. *Panicum strigosum* Muhl. in Ell. Bot. S. C. & Ga. 1: 126. 1816.

Type locality, South Carolina.

RANGE: Middle eastern United States to Guatemala.

46. *Panicum ovinum* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Circ. 16: 3. 1899.

Type locality, "Waller County, Texas."

RANGE: Southern Mississippi Valley to Veracruz.

47. *Panicum multirameum* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 19: 2. 1900.

Type locality, "Gravelly hills near Jalapa, State of Veracruz."

RANGE: Southern Mexico and Guatemala.

48. *Panicum olivaceum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 225. f. 234. 1910.

Type locality, "Coban, Department of Alta Vera Paz, Guatemala."

RANGE: Veracruz to South America.

49. *Panicum pseudopubescens* Nash, Bull. Torrey Club 26: 577. 1899.

Type locality, "Auburn, Lee Co., Alabama."

RANGE: Northeastern United States to northern Mexico.

50. *Panicum sphaerocarpon* Ell. Bot. S. C. & Ga. 1: 125. 1816.

Type locality, "Georgia."

RANGE: Northeastern United States to South America.



**51. *Panicum nodatum*** Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 293. *f.* 331. 1910.

Type locality, "Sarita, Texas."

RANGE: Southern Texas and northern Mexico.

**52. *Panicum viscidellum*** Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 19: 2. 1900.

Type locality, "Gravelly banks near Jalapa, Veracruz."

RANGE: Veracruz to South America.

**53. *Panicum jorii*** Vasey, U. S. Dept. Agr. Div. Bot. Bull. 8: 31. 1889.

Type locality, "Louisiana."

RANGE: Middle Atlantic States to Veracruz.

**54. *Panicum albomaculatum*** Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 19: 2. 1900.

Type locality, "Dry rocky hills, Patzcuaro, State of Michoacan," Mexico.

RANGE: Southwestern Mexico.

#### MISCELLANEOUS SPECIES.

**55. *Panicum obtusum*** H. B. K. Nov. Gen. & Sp. 1: 98. 1816.

Type locality, "In planitie montana regni Mexicani, prope Guanaxuato."

RANGE: Southwestern United States to southern Mexico.

**56. *Panicum zizanioides*** H. B. K. Nov. Gen. & Sp. 1: 100. 1816.

Type locality, "In calidissimis regni Novagranatensis, in ripa fluminis Magdalenae, inter Borjorque et Los Praxarales de Sogamozo," Colombia.

RANGE: Mexico, West Indies and south to Paraguay.

**36. *ICHNANTHUS*** Beauv. Ess. Agrost. 56. *pl.* 12. *f.* I. 1812.

#### KEY TO THE SPECIES.

Stems erect; blades firm, 1 to 1.5 cm. wide; spikelets strongly ribbed. 1. *I. lanceolatus*.  
Stems creeping and rooting; blades thin; spikelets nerved but scarcely ribbed.

Spikelets acuminate; blades ovate-lanceolate..... 2. *I. pallens*.

Spikelets obtuse; blades linear-lanceolate..... 3. *I. apiculatus*.

**1. *Ichnanthus lanceolatus*** Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 36. *pl.* 5. 1897.

Type locality, "Old fields about Izamal," Yucatán, the type specimen collected by Gaumer (no. 854).

RANGE: Known only from the type collection.

**2. *Ichnanthus pallens*** (Swartz) Munro in Benth. Fl. Hongk. 414. 1861.

*Panicum pallens* Swartz, Prodr. Veg. Ind. Occ. 23. 1788.

Type locality, "Jamaica."

RANGE: Tropics of the Western Hemisphere.

#### HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Las Canóas, rich woods in barranca, *Pringle* 3827.

VERACRUZ: Jalapa, damp shady bank, *Hitchcock* 6649; shady spring, *Hitchcock* 6675. Córdoba, wet shady bank, *Hitchcock* 6454. Mirador, *Liebmann* 400.

**3. *Ichnanthus apiculatus*** Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 1. 1901.

Type locality, "Near Jalapa, State of Veracruz," the type specimen collected by *Pringle* (no. 9208).

RANGE: Southern Mexico to Panama.

#### HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Jalapa, among shrubs at edge of woods, *Hitchcock* 6611; *Pringle* 9208, type (in *Hitchcock* Herb.).



**37. LASIACIS** (Griseb.) Hitchc. Contr. U. S. Nat. Herb. 15: 16. 1910.

## BAMBOO PANICUM.

## KEY TO THE SPECIES.

- Spikelets globose, small, 3 mm. long..... 1. *L. globosa*.  
 Spikelets oval or obovate, 3 to 5 mm. long.  
   Blades conspicuously cordate-clasping; panicle diffuse, as  
     much as 75 cm. long..... 9. *L. procerrima*.  
   Blades not conspicuously clasping; panicle usually not more  
     than 20 cm. long.  
     Plants decumbent and creeping at base, rooting at the  
       nodes; fertile culms usually not more than about  
       1 meter high.  
       Blades narrow, glabrous above; spikelets not clus-  
       tered; stems about 0.5 meter high..... 2. *L. grisebachii*.  
       Blades scabrous above; spikelets in clusters of 2 to  
       4 at the ends of the panicle branches.  
         Blades elongated; sheaths glabrous..... 8. *L. oaxacensis*.  
         Blades ovate-lanceolate; sheaths pubescent.... 7. *L. rhizophora*.  
     Plants climbing high, forming strong central canes some-  
       times several meters long.  
       Panicle compact; blades broad, oval to lanceolate. 4. *L. compacta*.  
       Panicle open; blades lanceolate.  
         Blades smooth or somewhat scabrous; canes,  
           branches, and young shoots smooth..... 3. *L. divaricata*.  
         Blades pubescent at least below; young shoots  
           villous; branches and canes pubescent or  
           rough.  
           Blades velvety; floral branchlets not clus-  
           tered on the strong main canes, the  
           panicles large, mostly 20 to 30 cm.  
           long, the blades mostly large, as much  
           as 2 cm. wide and 15 cm. long..... 6. *L. swartziana*.  
           Blades more or less pubescent but not vel-  
           vety; floral branches often clustered  
           or fascicled on the strong main canes,  
           the panicles and blades smaller..... 5. *L. liebmänniana*.

**1. *Lasiacis globosa* sp. nov.**

Stems woody as in *L. divaricata*, glabrous; sheaths glabrous, ciliate on the overlapping margin; ligule a narrow pilose membrane about 0.5 mm. long; blades firm, elliptical-lanceolate, scabrous on the margins and upper surface and more or less so beneath, those of the flowering branches 1 to 2 cm. wide, 8 to 12 cm. long; panicle pyramidal, loosely flowered, 6 to 15 cm. long, the branches very scabrous, widely spreading, the longer as much as 7 cm. long; spikelets on scabrous pedicels 1 to 2 cm. long, globose, 3 mm. long; first glume circular, gibbous, nerved, scabrous on the keel, ciliate on the membranous margin, about 1 mm. long; second glume and sterile lemma glabrous and shining, equal, a little shorter than the fertile lemma, reticulate-veined, lanate-ciliate on the rounded apex; fertile lemma umbonate, the point protruding from the second glume and sterile lemma, this and the apex of the palea woolly.

Type in the U. S. National Herbarium, no. 691226, collected at Acapulco, Mexico, by Edward Palmer (no. 114 in 1894).



What appears to be the same species is found in western South America. Among the specimens is *Lechler* 2219 from Peru, which was mentioned without description by Steudel<sup>1</sup> in his list of Lechler's plants, under the name *Panicum megacarpum*. This name appears not to have been published, though it is given as a synonym by Grisebach, Doell, and others under *Panicum divaricatum* or some of its allies.

**2. *Lasiacis grisebachii* (Nash) Hitchc. Bot. Gaz. 51: 302. 1911.**

*Panicum grisebachii* Nash, Bull. Torrey Club 35: 301. 1908.

Type locality, Madruga, Cuba, the type specimen collected by Britton & Shafer (no. 758).

RANGE: Eastern Mexico and Central America, and the West Indies.

HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Córdoba, *Fink* in 1893.

**3. *Lasiacis divaricata* (L.) Hitchc. Contr. U. S. Nat. Herb. 15: 16. 1910.**

*Panicum divaricatum* L. Syst. Nat. ed. 10. 871. 1759.

Type locality, Jamaica, the type collected by Browne.

RANGE: Southern Florida, West Indies, and Mexico to South America.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandeggee* in 1890.

SINALOA: Rosario, *Rose* in 1897.

JALISCO: Tequila, *Palmer* 362 in 1886.

SAN LUIS POTOSÍ: Minas de San Rafael, *Purpus* 5439, 5440.

COLIMA: Manzanillo, woods on hill near coast, *Hitchcock* 7027, 7028; wooded hillside, *Hitchcock* 7035; base of cliff on sea shore in reach of spray, *Hitchcock* 7044; *Palmer* 1089 in 1890. Alzada, shady ravine among shrubs, *Hitchcock* 7087; hillside among shrubs, *Hitchcock* 7099.

VERACRUZ: Mirador, *Liebmann* 298. Pital, *Liebmann* 294. Orizaba, near top of hill, *Hitchcock* 6393.

YUCATÁN: Mérida, *Schott* 675.

**4. *Lasiacis compacta* (Swartz) Hitchc. Bot. Gaz. 51: 302. 1911.**

*Panicum compactum* Swartz, Adnot. Bot. 14. 1829.

Type locality unknown.

RANGE: Mexico and West Indies to South America.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Sierra de Alamos, *Rose, Standley & Russell* 12822.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 10 in 1885.

SINALOA: Mazatlán, dry field, *Rose, Standley & Russell* 14112. Culiacán, *Brandeggee* in 1904. Rosario, thickets, *Rose, Standley & Russell* 14521. San Blas, thickets along Río Fuerte, *Rose, Standley & Russell* 13369. Imala, *Palmer* in 1891. Lodiago, shady river banks, *Palmer* 1645 in 1891.

DURANGO: Huasemote, *Rose* 3502.

TEPIC: Acaponeta, *Rose, Standley & Russell* 14409.

COLIMA: Manzanillo, wooded hillside, *Hitchcock* 7034. Alzada, wooded rocky hillside, *Hitchcock* 7079.

MICHOACÁN: El Calabazal, *Langlassé* 458. Vallecitos, *Langlassé* 361.

MORELOS: Yautepec, lava fields, *Pringle* 11293.

GUERRERO: Tlalixtaquilla, *Nelson* 2254. Acapulco, *Palmer* 115 in 1894.

OAXACA: San Miguel Sadani, *Liebmann* 283. Oaxaca, *Conzatti & González* 1103.

YUCATÁN: Izamal, *Gaumer* 878. Mérida, *Schott* 600.

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<sup>1</sup> Lechl. Berb. Amer. Austr. 56. 1857.



- 5. *Lasiacis liebmanna*** (Fourn.) Hitchc. Proc. Biol. Soc. Washington **24**: 145. 1911.

*Panicum liebmanna* Fourn. Mex. Pl. **2**: 33. 1886.

Type locality, "Consoquitla," Mexico, the type specimen collected by Liebmann (no. 299).

RANGE: Mexico to Colombia.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 10 in 1885.

SAN LUIS POTOSÍ: Las Canóas, rocky hills, *Pringle* 3808. San Dieguito, *Palmer* 151 in 1904. Río de las Gallinas, *Purpus* 5438.

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7348, 7368. San Nicolás, sterile clay hill, *Hitchcock* 7207.

GUANAJUATO, Guanajuato, *Dugès* in 1897.

VERACRUZ: Orizaba, *Bourgeau* 2648; *Botteri* 754; shaded rich loam near top of hill, *Hitchcock* 6389. Colipa, *Liebmann* 290. Córdoba, climbing 15-20 feet high in coffee trees, *Hitchcock* 6442; in cut, *Hitchcock* 6455, 6456; climbing over bushes along road, *Hitchcock* 6458; *Seaton* 393; *Fink* in 1893; *Bourgeau* 1499, 1936. Jalapa, railway cut through jungle, *Hitchcock* 6642; in shade, edge of coffee grove, *Hitchcock* 6674; railway cut, *Hitchcock* 6680; *Rose & Hay* 6144. Mirador, *Ross* 254, 613; *Liebmann* 296. Zacuapan, *Purpus* 2905, 3779. Misantla, *Purpus* 5978.

MORELOS: Cuernavaca, rocky places, *Pringle* 6663; along deep ravine, *Hitchcock* 6824.

OAXACA: Tomellín Canyon, *Pringle* 6701. Trapiche de la Concepción, *Liebmann* 284. San Pablo Huitzo, *Conzatti* 2012.

- 6. *Lasiacis swartziana*** Hitchc. Bot. Gaz. **51**: 302. 1911.

*Panicum swartzianum* Hitchc. Contr. U. S. Nat. Herb. **12**: 140. 1908.

*Panicum lanatum* Swartz, Prodr. Veg. Ind. Occ. **24**. 1788, not Rottb. 1776.

Type locality, "Jamaica."

RANGE: Mexico and the West Indies.

HERBARIUM SPECIMEN FROM MEXICO:

OAXACA: Tuxtepec, *Nelson* 372.

- 7. *Lasiacis rhizophora*** (Fourn.) Hitchc. Proc. Biol. Soc. Washington **24**: 145. 1911.

*Panicum rhizophorum* Fourn. Mex. Pl. **2**: 31. 1886.

Type locality, "Orizaba," the type specimen collected by Bourgeau (no. 3025).

RANGE: Mexico and Central America.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Córdoba, edge of jungle, *Hitchcock* 6461. Orizaba, *Botteri*; *Bourgeau* 3025. Zacuapan, *Purpus* 6205.

- 8. *Lasiacis oaxacensis*** (Steud.) Hitchc. Proc. Biol. Soc. Washington **24**: 145. 1911.

*Panicum oaxacense* Steud. Syn. Pl. Glum. **1**: 73. 1854.

Type locality, "Oaxaca."

RANGE: Mexico and Central America.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Pital, *Liebmann* 285. Zacuapan, moist ground, *Purpus* 2157.

MICHOACÁN: Sierra Madre, *Langlassé* 556. Morelia, *Arsène* in 1909.

- 9. *Lasiacis procerrima*** (Hack.) Hitchc. Proc. Biol. Soc. Washington **24**: 145. 1911.

*Panicum procerrimum* Hack. Oesterr. Bot. Zeitschr. **51**: 431. 1901.

Type locality, "Costarica: Inter frutices ad fluvium Tiliri prope La Verbena et Alajuelita," the type specimen collected by Pittier (no. 8819).

RANGE: Central Mexico to Panama.



## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Colomas, foothills of Sierra Madre, *Rose* 1687.

TEPIC: Tepic, river banks and arroyos, *Palmer* 1921 in 1892.

JALISCO: Río Blanco, *Palmer* 535 in 1886. Guadalajara, barranca, *Pringle* 11760; shaded ledges, *Pringle* 1732.

COLIMA: Alzada, rocky hillside, *Hitchcock* 7085.

MICHOACÁN: El Ocote, *Langlassé* 540.

VERACRUZ: Córdoba, *Fink* in 1893; excavated area, clay soil, *Hitchcock* 6422.

Orizaba, open woods, hilltop, *Hitchcock* 6385. Mirador, *Liebmann* 305.

Veracruz, *Galeotti* 5717.

CHIAPAS: Ocuilapa, table-land, *Nelson* 3055.

38. **SACCIOLEPIS** Nash in Britton, Man. 89. 1901.

1. **Sacciolepis myuros** (Lam.) Chase, Proc. Biol. Soc. Washington 21: 7. 1908.

*Panicum myuros* Lam. Tabl. Encycl. 1: 172. 1791.

Type locality, Cayenne, according to the label on the type specimen.

RANGE: Mexico and West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, shallow pools, *Pringle* 2363.

VERACRUZ: Potrero de Consoquitla, *Liebmann* 146.

39. **HYMENACHNE** Beauv. Ess. Agrost. 48. pl. 10. f. 8. 1812.

1. **Hymenachne amplexicaulis** (Rudge) Nees, Agrost. Bras. 276. 1829.

*Panicum amplexicaule* Rudge, Pl. Guian. 1: 21. pl. 27. 1805.

Type locality, British Guiana.

RANGE: Tropics and subtropics of the western hemisphere.

## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Culiacán, *Palmer* 1791 in 1891.

COLIMA: Colima, *Palmer* 1259 in 1891; *Orcutt* 4563.

VERACRUZ: Sanborn, *Orcutt* 3249.

OAXACA: Mazaltepec, *Rovirosa* 628.

40. **HOMOLEPIS** Chase, Proc. Biol. Soc. Washington 24: 146. 1911.

1. **Homolepis aturensis** (H. B. K.) Chase, Proc. Biol. Soc. Washington 24: 146. 1911.

*Panicum aturense* H. B. K. Nov. Gen. & Sp. 1: 103. pl. 33. 1816.

Type locality, "ad cataractas Aturensis," in the Atabapo River, between Venezuela and Colombia.

RANGE: Southern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Jicaltepec, *Liebmann* 391. Inter Isleta et Malvapán, *Liebmann* 395.

OAXACA: Comaltepec, *Galeotti* 5859.

TABASCO: Mayito, *Rovirosa* 425.

41. **ISACHNE** R. Br. Prodr. Fl. Nov. Holl. 196. 1810.

1. **Isachne arundinacea** (Swartz) Griseb. Fl. Brit. W. Ind. 553. 1864

*Panicum arundinaceum* Swartz, Prodr. Veg. Ind. Occ. 24. 1788.

Type locality, "Jamaica."

RANGE: Mexico and West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Mirador, *Liebmann* 333. Consoquitla, *Liebmann* 331. Jalapa, *Smith* 1804. Zacuapan, open woods, *Purpus* 2000.

OAXACA: *Galeotti* 5868.

CHIAPAS: Chicharras, *Nelson* 3764.



**42. OPLISMENUS** Beauv. Fl. Owar. 2: 14. pl. 58. f. 1. 1809.

## KEY TO THE SPECIES.

- Spikelets loosely arranged on the elongated axis of the spikes. . . . . 1. *O. rariflorus*.  
 Spikelets compactly arranged on the short axes of the spikes.  
     Spikes villous with long hairs. . . . . 3. *O. cristatus*.  
     Spikes not villous, or with a few long hairs. . . . . 2. *O. hirtellus*.

**1. Oplismenus rariflorus** Presl, Rel. Haenk. 1: 320. 1830.

Type locality, "ad Acapulco."

RANGE: Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Lodiago, moist shady place in deep canyon, *Palmer* 1656 in 1891.TEPIC: Tepic, shady bank of arroyo, *Palmer* 1931 in 1892.JALISCO: Zapotlán, open pine woods, hillside, *Hitchcock* 7237.COLIMA: Mazanillo, *Palmer* 1090 in 1890.MICHUACÁN: La Correa, *Langlassé* 444. Morelia, *Arsène* in 1909.OAXACA: Sierra de San Felipe, *Pringle* 4944. Reyes, *Nelson* 1772. Between Galera and Pochutla, *Liebmann* 372.**2. Oplismenus hirtellus** (L.) Roem. & Schult. Syst. Veg. 2: 481. 1817.*Panicum hirtellum* L. Syst. Nat. ed. 10. 870. 1759.

Type locality, Jamaica, the type specimen collected by Browne.

RANGE: Mexico and the West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

PUEBLA: Mount Orizaba, *Seaton* 63.VERACRUZ: Córdoba, wet springy bank, *Hitchcock* 6445; in shade of coffee trees, *Hitchcock* 6462. Jalapa, damp shady woods, *Hitchcock* 6636, 6637; shady place near Coatepec, *Hitchcock* 6681. Orizaba, *Botteri* 136; *Purpus* in 1903. Colipa, *Liebmann* 363. Mirador, *Nelson* 109. Sanborn, *Orcutt* 3067.MORELOS: Cuernavaca, moist banks, *Pringle* 6203; damp shady place in ravine, *Hitchcock* 6839.TABASCO: San Juan Bautista, *Rovirosa* 67, 83.CHIAPAS: Ocuilapa, table-land, *Nelson* 3025.QUINTANA ROO: Cozumel, *Millsbaugh* 1483.WITHOUT LOCALITY: *Liebmann* 366.**3. Oplismenus cristatus** Presl, Rel. Haenk. 1: 323. 1830.

Type locality, "Mexico."

RANGE: Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Miraflores, *Brandegge* 22 in 1890. Sierra de la Laguna, *Brandegge* 5 in 1890.SINALOA: Lodiago, moist shady rocky canyon, *Palmer* 1666 in 1891.TEPIC: Tepic, shady banks of arroyos, *Palmer* 1930 in 1892.JALISCO: Guadalajara, *Palmer* 463 in 1886; along a stone wall near San Pedro, *Hitchcock* 7279. Zapotlán, damp shady place on rocks, hill, *Hitchcock* 7250.COLIMA: Colima, *Palmer* 1258 in 1891; *Orcutt* 4529.MICHUACÁN: La Correa, *Langlassé* 440. Morelia, *Arsène* in 1909.VERACRUZ: Zacuapan, fields, *Purpus* 2893.MORELOS: Cuernavaca, shaded banks, *Pringle* 6209; lava fields near Yautepec, *Pringle* 11330; *Bourgeau* 1301.GUERRERO: Acapulco, *Palmer* 35 in 1894.OAXACA: Cuicatlán, *Nelson* 1649. Guatulco, *Liebmann* 375.YUCATÁN: Without locality, *Schott* 55.



43. **ECHINOCHLOA** Beauv. Ess. Agrost. 53. pl. 11. f. 2. 1812.

## KEY TO THE SPECIES.

- Spikelets awnless or mucronate only; spikes simple, rather remote. 1. *E. colonum*.  
 Spikelets more or less awned; spikes more or less compound, approximate.  
 Sheaths hispid..... 4. *E. walteri*.  
 Sheaths glabrous.  
 Awns conspicuous.  
 Awns as much as 5 cm. long; panicle long and dense.. 5. *E. holciformis*.  
 Awns less than 2 cm. long; panicle mostly not over 15  
 cm. long, not dense..... 6. *E. spectabilis*.  
 Awns not longer than the body of the spikelet.  
 Panicle erect; branches stiffly ascending or appressed;  
 awns mostly less than 1 mm. long..... 2. *E. zelayensis*.  
 Panicle nodding, rather soft and lax; awns 1 to 5 mm.  
 long..... 3. *E. sabulicola*.

1. **Echinochloa colonum**<sup>1</sup> (L.) Link, Hort. Berol. 2: 209. 1833.

*Panicum colonum* L. Syst. Nat. ed. 10. 870. 1759.

Type locality, Jamaica, the type specimen from Browne.

RANGE: Warmer parts of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Agueda, *Palmer* 223 in 1890. San José del Cabo, *Brandege* 26 in 1890, 38 in 1899.

SONORA: Oputo, *Hartman* 189. Nogales to Cocospora Ranch, *Griffiths* 6832. Yaqui River, *Palmer* 13 and 14 in 1869. Sierra de Alamos, *Rose, Standley & Russell* 12984. Guaymas, moist roadside, *Hitchcock* 3560; *Palmer* 51 and 202 in 1887. Hermosillo, by ditch in meadow, *Hitchcock* 3580; weed in field, *Hitchcock* 3620.

CHIHUAHUA: Sánchez, along railway, *Hitchcock* 7690. Chihuahua, depression in mesa, *Hitchcock* 7780. Santa Eulalia Plains, *Wilkinson* 42.

SINALOA: Topolobampo, *Rose, Standley & Russell* 13265. Mazatlán, moist field, *Rose, Standley & Russell* 14039. San Blas, *Rose, Standley & Russell* 13424. Culiacán, rich bottom lands, *Palmer* 1542 in 1891. Rosario, along the river, *Rose, Standley & Russell* 14574; *Rose* 1544.

DURANGO: Torreón, field, *Hitchcock* 7552. Durango, in water of ditch, *Hitchcock* 7655. Tlahualilo, *Pittier* 478.

COAHUILA: Saltillo, along irrigation ditch, *Hitchcock* 5592; field, *Hitchcock* 5599.

NUEVO LEÓN: Monterrey, irrigation ditch, *Hitchcock* 5548.

TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14250; *Rose* 1923.

SAN LUIS POTOSÍ: Cárdenas, irrigated field, *Hitchcock* 5750.

JALISCO: Río Blanco, *Palmer* 193 in 1886. San Nicolás, cornfield, *Hitchcock* 7224.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7413. Acámbaro, along ditch, *Hitchcock* 6941.

QUERÉTARO: Querétaro, water of irrigation ditch, *Hitchcock* 5831.

COLIMA: Colima, in swampy ground and along water courses, *Palmer* 169 in 1897. Caldras, along railway, *Hitchcock* 7020.

PUEBLA: Tehuacán, along ditch, *Hitchcock* 6052. Cholula, *Nicolas* in 1910.

<sup>1</sup> Dr. E. L. Greene called attention to the fact that the specific name is not an adjective, and suggested that it is probably a genitive plural. The word appears to be contracted from *colonorum*, genitive plural of *colonus*, a husbandman or a colonist. Dr. J. A. Nieuwland has kindly searched Latin authorities and verifies this conclusion, though there appears to be no direct authority for the word *colonum*.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

VERACRUZ: Veracruz, weed along street, *Hitchcock* 6569. Valley of Orizaba, *Bourgeau* 2593. Río Blanco, roadside ditch, *Hitchcock* 6325.

MORELOS: Cuernavaca, weed in pasture, *Hitchcock* 6836.

GUERRERO: Balsas, along railway, *Hitchcock* 6802. Iguala, in Canyon de la Mano Negra, *Rose, Painter & Rose* 9386.

OAXACA: Tomellín, *Rose, Painter & Rose* 10048; weed in cornfield, *Hitchcock* 6228. Oaxaca, edge of water in ditch, *Hitchcock* 6125.

2. *Echinochloa zelayensis* (H. B. K.) Schult. Mant. 2: 269. 1824.

*Oplismenus zelayensis* H. B. K. Nov. Gen. & Sp. 1: 108. 1816.

Type locality, "in alta planitie montana regni Mexicaní prope Zelaya, Queretaro."

RANGE: Southwestern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Horseshoe Bend of the Colorado River, *Palmer* 949 and 950 in 1889.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 18 in 1885. Casas Grandes, *Townsend & Barber* 353.

DURANGO: Durango, in water of ditch; *Hitchcock* 7565, 7566; along water courses and ditches, sometimes in shallow water, *Palmer* 252 in 1896. Santiago Papasquiaro, along water courses, *Palmer* 466 in 1896. Torreón, along ditch, *Hitchcock* 7725.

COAHUILA: Saltillo, in wet soil, *Palmer* 380 in 1898; wet irrigation ditch, *Hitchcock* 5600, 5606, 5607, 5612.

ZACATECAS: Zacatecas, along dry river bed, *Hitchcock* 7526.

AGUASCALIENTES: Aguascalientes, along pond, *Hitchcock* 7486; weed along road, edge of field, *Hitchcock* 7442.

SAN LUIS POTOSÍ: San Luis Potosí, dry ditch, *Hitchcock* 5655.

JALISCO: Orozco, shallow water of large pond, *Hitchcock* 7385. Guadalajara, *Palmer* 430 in 1886; in water of ditch on road to Barranca de Oblatos, *Hitchcock* 7310, 7314. Colotlán, *Rose* 3606.

GUANAJUATO: Acámbaro, along ditch, *Hitchcock* 6935. Irapuato, along ditch, *Hitchcock* 7387; moist sandy-clay plain by ditch, *Hitchcock* 7398, 7399, 7421. Guanajuato, *Dugès* in 1897.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5820, 5835, 5850, 5851, 5867.

MÉXICO: Valley of Mexico, *Pringle* 9585; *Orcutt* 4105. Xochimilco, ditch, *Hitchcock* 5894. Santa Anita, *Bourgeau* 680. Near Mexico City, ditches, *Bourgeau* 236.

PUEBLA: Tehuacán, along railway ditch, *Hitchcock* 6061.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6326.

OAXACA: Oaxaca, water of ditch, *Hitchcock* 6175, 6181.

WITHOUT LOCALITY: *Liebmann* 386.

3. *Echinochloa sabulicola* (Nees).

*Panicum sabulicola* Nees, Agrost. Bras. 258. 1829.

Type locality, South America, "in arenosis Paræ" and "in Monte Video, et in confinibus Regni Paraguayaní" cited.

RANGE: Northern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: La Paz, *Palmer* 130 in 1890.

SONORA: Hermosillo, along ditch, *Hitchcock* 3599.

CHIHUAHUA: Between Casas Grandes and Sabinal, *Nelson* 6355a. Between Colonia García and Pratt's ranch, *Nelson* 6244.

SINALOA: Culiacán, *Palmer* 1790 in 1891.

DURANGO: Durango, in swamps, often in water, *Palmer* 730 in 1896.

COAHUILA: Jaral, *Schumann* 1738. Saltillo, common in wet places, *Palmer* 418 in 1898.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

JALISCO: Orozco, near large pond, *Hitchcock* 7373. Guadalajara, *Palmer* 430 and 430a in 1886; along stream, side of Barranca de Oblatos, *Hitchcock* 7351.

GUANAJUATO: Acámbaro, along ditch, *Hitchcock* 6949. Irapuato, moist sandy-clay plain, *Hitchcock* 7420.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5810, 5852, 5866.

MICHOACÁN: Maravatio, *Hitchcock* 6923. Morelia, *Rose* 3591.

MÉXICO: Valley of Mexico, *Pringle* 9606; in shallow water, *Pringle* 8572; *Bourgeau* 530. Xochimilco, ditch along trolley, *Hitchcock* 5879.

VERACRUZ: Córdoba, weed in field, *Hitchcock* 6452. Orizaba, *Botteri* 718; roadside ditch, *Hitchcock* 6344. San Francisco near Veracruz, *Smith* 1329.

MORELOS: Cuernavaca, along ditch, *Hitchcock* 6849.

4. *Echinochloa walteri* (Pursh) Heller, Cat. Pl. N. Amer. ed. 2. 21. 1900.

*Panicum walteri* Pursh, Fl. Amer. Sept. 1: 66. 1814.

Type locality, South Carolina, Pursh bestowing the name on the species erroneously referred by Walter to *Panicum hirtellum*.

RANGE: United States to Southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Cárdenas, along irrigation ditch, *Hitchcock* 5737.

TABASCO: González, along river bank, *Rovirosa* 703.

5. *Echinochloa holciformis* (H. B. K.) Chase, Proc. Biol. Soc. Washington 24: 155. 1911.

*Oplismenus holciformis* H. B. K. Nov. Gen. & Sp. 1: 107. 1816.

Type locality, "in humidis montanis prope Cinapecuario, alt. 970 hexap. (Regno Mexicano.)"

RANGE: Mexico and Central America.

## HERBARIUM SPECIMENS FROM MEXICO:

DURANGO: Durango, in water of pond, *Hitchcock* 7611. Along water courses, sometimes in shallow water, *Palmer* 253 in 1896.

JALISCO: Orozco, margin of large pond, *Hitchcock* 7375.

GUANAJUATO: Acámbaro, water of ditch, *Hitchcock* 6946. Irapuato, along ditch, *Hitchcock* 7393.

MICHOACÁN: Morelia, *Arsène* in 1909.

MÉXICO: Valley of Mexico, *Pringle* 8622.

6. *Echinochloa spectabilis* (Nees) Link, Hort. Berol. 2: 209. 1833.

*Panicum spectabile* Nees, Agrost. Bras. 262. 1829.

Type locality, "Rio de Janeiro," the species believed by Nees to be introduced from Angola, Africa.

RANGE: Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Cananea, *Ricketts* 2.

CHIHUAHUA: Sánchez, along railway, *Hitchcock* 7696. Miñaca, along railway, *Hitchcock* 7758. Sierra Madre, wet places, *Pringle* 1404.

DURANGO: Durango, along dry creek bed, *Hitchcock* 7616; *Palmer* 253 in 1896. Otinapa, *Palmer* 333 in 1906.

ZACATECAS: Zacatecas, along dry river bed, *Hitchcock* 7527.

AGUASCALIENTES: Aguascalientes, in dry ditch, *Hitchcock* 7441; along pond, *Hitchcock* 7489.

MICHOACÁN: Zamora, in water, *Pringle* 8480. Morelia, *Nicolas* in 1909.

MÉXICO: Toluca, along ditch, *Hitchcock* 6914.

TABASCO: Laguna de Peralta, *Rovirosa* 315.



**44. CHAETIUM** Nees, Agrost. Bras. 269. 1829.

1. *Chaetium bromoides* (Presl) Benth.; Hemsl. Biol. Centr. Amer. Bot. 3: 503. 1885.

*Berchtoldia bromoides* Presl, Rel. Haenk. 1: 324. pl. 43. 1830.

Type locality, "Mexico."

RANGE: Mexico and Central America.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, *Palmer* in 1886.

JALISCO: Zapotlán, railway right of way, *Hitchcock* 7114. Guadalajara, prairie near San Pedro, *Hitchcock* 7287; plains, *Pringle* 2331; gravelly banks, *Pringle* 11736. Río Blanco, *Palmer* 619 in 1886.

MICHOACÁN: Uruápan, prairie along railway, *Hitchcock* 6985.

VERACRUZ: Orizaba, in bunches along ditch, *Hitchcock* 6330; *Botteri*; Tzuatlanchillo near Orizaba, *Bourgeau* 2597.

MORELOS: Cuernavaca, edge of orchard, *Hitchcock* 6856.

**45. SETARIOPSIS** Scribn. in Millsp. Field Mus. Bot. 1: 288. pl. 11. 1896.

## KEY TO THE SPECIES.

- Sheaths hispid; glumes conspicuously widened. . . . . 1. *S. latiglumis*.  
 Sheaths smooth; glumes not conspicuously widened. . . . . 2. *S. auriculata*.

1. *Setariopsis latiglumis* (Vasey) Scribn. in Millsp. Field Mus. Bot. 1: 289. pl. 11. 1896.

*Setaria latiglumis* Vasey, Bull. Torrey Club 13: 229. 1886.

Type locality, "S. W. Chihuahua," the type specimen "collected by Dr. Ed. Palmer in 1885."

RANGE: Pacific slope of Mexico.

HERBARIUM SPECIMENS:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 117a in 1885.

JALISCO: Bolaños, *Rose* 2899.

MORELOS: Jojutla, limestone hills, *Pringle* 11246.

GUERRERO: Iguala, mountains, *Pringle* 8412. Río Balsas, *Orcutt* 4198.

CHIAPAS: Tuxtla, *Nelson* 3083.

2. *Setariopsis auriculata* (Fourn.) Scribn. in Millsp. Field Mus. Bot. 1: 289. 1896.

*Setaria auriculata* Fourn. Mex. Pl. 2: 43. 1886.

Type locality, "Campeche," the type specimen collected by Linden.

RANGE: Sonora to Oaxaca and Yucatán.

HERBARIUM SPECIMENS:

SONORA: Alamos, *Palmer* 684 in 1890.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 78 in 1885.

JALISCO: Bolaños, *Rose* 2899.

COLIMA: Alzada, along track, *Hitchcock* 7092; in low wet spot, *Palmer* 139 in 1897.

MORELOS: Los Amates, *Orcutt* 4428. Yautepec, *Rose, Painter & Rose* 8538.

GUERRERO: Los Amates, near railway, *Hitchcock* 6693.

OAXACA: Tomellín, rocky hill, *Hitchcock* 6242. Cuicatlán, *Nelson* 1601.

YUCATÁN: Mérida, *Schott* 592. Izamal, *Gaumer* 849.

**46. CHAETOCHLOA** Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 38. 1897.

## KEY TO THE SPECIES.

Bristles barbed backwards.

Collar glabrous or nearly so; spikelets elliptical. . . . . 12. *C. verticillata*.

Collar densely hirsute; spikelets globose. . . . . 13. *C. salzmänniana*.



## Bristles barbed forwards.

Blades broad, the larger ones 4 cm. or more wide, plaited,  
tapering at both ends. (§PTYCHOPHYLLUM.)

Panicle rather compact, the branches ascending or  
appressed, 1 to 4 cm. long..... 1. *C. sulcata*.

Panicle loose and open, the branches slender and  
spreading, 10 to 20 cm. long..... 2. *C. effusa*.

Blades narrow, not plaited.

Plants annual.

Fertile lemma transversely striate but not  
deeply rugose.

Panicle rather compact, the branches short. 6. *C. grisebachii*.

Panicle looser, the branches 1 to 3 cm. long. 6a. *C. grisebachii ampla*.

Fertile lemma deeply transversely rugose.

Blades pilose beneath..... 5. *C. latifolia*.

Blades scabrous but not pilose.

Panicle dense, spike-like; blades nar-  
rowed at base, spreading, a dense  
tuft of hairs 2 to 3 mm. long in  
the region of the ligule and  
collar..... 3. *C. longipila*.

Panicle loosely spike-like; blades cor-  
date at base, appressed, the  
ligule short..... 4. *C. liebmanni*.

Plants perennial.

Inflorescence a close cylindrical spike-like  
panicle.

Blades flat, averaging 1 cm. in width..... 11. *C. imberbis*.

Blades mostly involute, narrow..... 10. *C. gracilis*.

Inflorescence loose, tapering at apex.

Sheaths smooth around the collar; panicle  
compact, usually less than 10 cm.  
long; blades usually narrow and  
folded..... 9. *C. composita*.

Sheaths hispid or villous around the collar;  
panicle loose and interrupted, usu-  
ally more than 15 cm. long.

Spikelets ovate-globose; blades usually  
broad and flat..... 7. *C. macrostachya*.

Spikelets elliptic..... 8. *C. setosa*.

1. *Chaetochloa sulcata* (Aubl.).

*Panicum sulcatum* Aubl. Pl. Guian. 1: 50. 1775.

Type locality, British Guiana, the species growing "au bord des rivières."

RANGE: Mexico to South America.

HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Las Canoas, by streams, *Pringle* 3921.

VERACRUZ: Jalapa, along railway in low woods, *Hitchcock* 6685. Mirador, *Liebmann* 459.

CHIAPAS: Turubula, *Nelson* 3359.



**2. *Chaetochloa effusa* (Fourn.).***Setaria effusa* Fourn. Mex. Pl. 2: 42. 1886.*Panicum mexicanum* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 21: 40. 1900.

Type locality, Veracruz, several localities in that State being given, Orizaba being the first.

RANGE: Southern Mexico and Central America.

**HERBARIUM SPECIMENS FROM MEXICO:**

VERACRUZ: Zacuapan, brushy woods, *Purpus* 2904; shady forests, *Purpus* 2907. Mirador, *Liebmann* 456. Córdoba, *Ross* 551; *Kerber* 110; along river bank, *Hitchcock* 6395; valley, *Bourgeau* 1457. Orizaba, open rocky hill, *Hitchcock* 6380; *Botteri* 1986.

OAXACA: Tonagua, *Liebmann* 454.

TABASCO: Tamulté, *Rovirosa* 616.

CHIAPAS: Ocuilapa, table-land, *Nelson* 3059.

**3. *Chaetochloa longipila* (Fourn.) Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 21: 22. 1900.***Setaria longipila* Fourn. Mex. Pl. 2: 47. 1886.

Type locality, presumably Mexico, the type specimen, collected by Jurgens (no. 722), being without data as to locality.

RANGE: Pacific slope of Mexico.

**HERBARIUM SPECIMEN:**

TEPIC: Between Aguacate and Dolores, *Rose* 2017.

**4. *Chaetochloa liebmanni* (Fourn.) Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 21: 31. 1900.***Setaria liebmanni* Fourn. Mex. Pl. 2: 44. 1886.

Type locality, "Manantial," the type specimen collected by Liebmann (no. 389).

RANGE: Pacific slope of Mexico.

**HERBARIUM SPECIMENS:**

LOWER CALIFORNIA: San José del Cabo, *Brandeggee* 12 in 1890.

SONORA: Guaymas, *Palmer* 191 in 1887; rocky lava hill, *Hitchcock* 3548. Alamos, *Palmer* 686 in 1890.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 52 and 110D in 1885.

SINALOA: Topolobampo, under shade of bushes, mountain slopes, *Palmer* 233 in 1897. Culiacán, *Brandeggee* 9 and 10 in 1904; common on rich bottom lands in shade, *Palmer* 1541 in 1891. Rosario, *Rose* 1840.

TEPIC: Acaponeta, *Rose* 3303.

COLIMA: Colima, in shady places on embankments, *Palmer* 8 in 1897; low grassy thicket, *Palmer* 142 in 1897.

GUERRERO: Río Balsas, *Orcutt* 4194.

OAXACA: Tomellín, side of cut along railway, *Hitchcock* 6191. Between San Gerónimo and La Venta, *Nelson* 2788.

**5. *Chaetochloa latifolia* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 44. pl. 3. 1898.**

Type locality, "deep ravines, Durango, Mexico," the type specimen collected by Palmer in 1896 (no. 879).

RANGE: Pacific slope of Mexico.

**HERBARIUM SPECIMENS:**

DURANGO: Santiago Papasquiario, under bushes in a ravine, *Palmer* 470 and 879 in 1896.

OAXACA: Valley of Oaxaca, *Conzatti & González* 347.



6. *Chaetochloa grisebachii* (Fourn.) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897.

*Setaria grisebachii* Fourn. Mex. Pl. 2: 45. 1886.

Type locality, Mexico, the following Mexican collections being cited: Mexico, *Berlandier* 622; Cerro de los Baños in valley of Mexico, *Bourgeau* 441; in silva de la Desierta Vieja, *Bourgeau* 1159; San Luis Potosí, *Virlet* 1337; Orizaba, *Schaffner* 36; Cañon de las Miñas et Victoria, *Karwinsky*; Tehuacán, *Liebmann* 361.

RANGE: Southwestern United States and Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Arroyo San Lagaro, *Brandeggee* in 1902.

SONORA: Guaymas, *Palmer* 191 in 1887. Hermosillo, rocky hill, *Hitchcock* 3607.

CHIHUAHUA: Chihuahua, shaded places, rocky hills, *Pringle* 381; along dry run, *Hitchcock* 7774. Sierra Madre, *Nelson* 6299.

DURANGO: Durango, dry ground, *Hitchcock* 7573; rocky hill, Iron Mountain, *Hitchcock* 7643; *Palmer* 716 in 1896. Torreón, rocky hill, *Hitchcock* 7546.

COAHUILA: Saltillo, *Palmer* 336 and 337 in 1904, 385 in 1898, 397 in 1904. Sabinas, *Nelson* 6820.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7461.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 957 in 1878; *Schaffner* 1044.

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7338, 7369.

GUANAJUATO: Irapuato, dry shrubby hill, *Hitchcock* 7427.

COLIMA: Manzanillo, along bluff, *Hitchcock* 7026.

MICHOACÁN: Morelia, *Arsène* in 1909.

MÉXICO: Río Hondo, *Holway* 11, 3153. Federal District, *Rose* 3554; *Holway* 3040; *Hitchcock* 7836; *Pringle* 9578, 9579; *Orcutt* 4342.

PUEBLA: Atlixco, *Nelson* in 1893. Tehuacán, cactus hill, *Hitchcock* 6095. San Marcos, railway embankment, *Hitchcock* 6512. Puebla, *Nicolas* in 1909.

GUERRERO: Balsas, gravelly soil along railway, *Hitchcock* 6774; open woods on hill, *Hitchcock* 6786.

OAXACA: El Parián, dry banks, *Pringle* 4937. Oaxaca, Monte Albán, *Smith* 939; along hedge, *Hitchcock* 6105; depression in rocky hill, *Hitchcock* 6156. Between Tule and Oaxaca, in mud near ditch, *Hitchcock* 6178, 6184.

- 6a. *Chaetochloa grisebachii ampla* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 21: 36. f. 21. 1900.

Type locality, "New Mexico, Organ mountains," the type collected by Vasey in 1881.

RANGE: Southwestern United States to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Saltillo, sandy field, river bottom, *Hitchcock* 5626; weed in park, *Hitchcock* 5641.

DURANGO: Durango, near spring, *Palmer* 728 in 1896.

FEDERAL DISTRICT: Waste place, *Hitchcock* 5911; along track, *Hitchcock* 5925; lava beds, *Pringle* 6470; *Orcutt* 3697.

OAXACA: Valley of Oaxaca, *Conzatti & González* 344.

7. *Chaetochloa macrostachya* (H. B. K.) Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 21: 29. f. 16. 1900.

*Setaria macrostachya* H. B. K. Nov. Gen. & Sp. 1: 110. 1816.

Type locality, "in planitie montana Mexicana inter Salamanca et Zelaya."

RANGE: Northern Mexico to South America.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Hermosillo, meadow near river, *Hitchcock* 3590. Guaymas, *Palmer* 53 in 1887.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

DURANGO: Durango, *Palmer* 378½ and 872 in 1896; rocky hill, Iron Mountain, *Hitchcock* 7623.

COAHUILA: Torreón, among mesquite bushes, *Palmer* 505 in 1898.

NUEVO LEÓN: Monterey, hills, *Pringle* 1968; edge of field, *Hitchcock* 5542.

TEPIC: San Blas, *Nelson* 4341.

SAN LUIS POTOSÍ: Cárdenas, along irrigation ditch, *Hitchcock* 5729.

QUERÉTARO: Querétaro, field among agaves, *Hitchcock* 5808.

PUEBLA: Tehuacán, along track, *Hitchcock* 6047.

VERACRUZ: Mirador, *Liebmann* 362.

OAXACA: Oaxaca, bottom land of river, *Hitchcock* 6068. Tomellín, copses along railway, *Hitchcock* 6241.

8. *Chaetochloa setosa* (Swartz) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897.

*Panicum setosum* Swartz, Prodr. Veg. Ind. Occ. 22. 1788.

Type locality, "Jamaica."

RANGE: Southwestern United States to West Indies and South America.

## HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Monterey, hills, *Pringle* 1968.

9. *Chaetochloa composita* (H. B. K.) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897.

*Setaria composita* H. B. K. Nov. Gen. & Sp. 1: 111. 1816.

Type locality, "regione calidissima prope Cumana et Bordones, in Nova Andalusia."

RANGE: Southwestern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Ensenada, *Orcutt* in 1889. San Pablo Canyon, *Purpus* 227.

La Paz, *Palmer* 125 in 1890. San José del Cabo, *Brandeggee* in 1890. Carmen Island, *Palmer* 857 in 1890.

SONORA: Guaymas, *Palmer* 340 in 1887. Alamos, *Rose, Standley & Russell* 13004.

CHIHUAHUA: Chihuahua, edge of field, *Hitchcock* 7775. Sabinal, *Nelson* 6368.

DURANGO: Torreón, along dry ditch, *Hitchcock* 7728. Tlahualilo, *Pittier* 471.

COAHUILA: Saltillo, along irrigation ditch, *Hitchcock* 5589, 5604, 5634; along fence rows, *Palmer* 378 in 1898. Parras, *Palmer* 1363 in 1890.

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5534.

ZACATECAS: Zacatecas, in gulch in dry, sterile hills, *Hitchcock* 7521. Concepción del Oro, *Palmer* 261 in 1904.

SAN LUIS POTOSÍ: San Luis Potosí, alfalfa field, *Hitchcock* 5665.

HIDALGO: Ixmiquilpan, limestone hillsides, *Rose, Painter & Rose* 8993.

PUEBLA: Tehuacán, hills east of city, *Rose, Painter & Rose* 10116.

10. *Chaetochloa gracilis* (H. B. K.) Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 21: 15. 1900.

*Setaria gracilis* H. B. K. Nov. Gen. & Sp. 1: 109. 1816.

Type locality, "inter Fusagasuga et Pandi \* \* \* (Regno Novogranatensi.)"

RANGE: Southwestern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, *Palmer* in 1885.

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5560.

JALISCO: Zapotlán, common in pine woods, hillside, *Hitchcock* 7239.

FEDERAL DISTRICT: Lava beds, *Pringle* 7171.

PUEBLA: Chalchicomula, rocky hill, *Hitchcock* 6278.

VERACRUZ: Córdoba, *Fink* 5.

OAXACA: Valley of Cuicatlán, mountain ridge, *Nelson* 1907.



11. *Chaetochloa imberbis* (Poir.) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897.

*Panicum imberbe* Poir. in Lam. Encycl. Suppl. 4: 272. 1817.

Type locality, "In America septentrionale & Brasilia."

RANGE: Northeastern United States to West Indies and South America.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandegge* 15 in 1890; *Purpus* 325.

SONORA: Hermosillo, moist adobe soil, *Hitchcock* 3586; cultivated ground, *Hitchcock* 3587; sandy bed of river, *Hitchcock* 3618; along ditch, *Hitchcock* 3625; *Maltby* 241; valley of Río de Sonora, *Rose, Standley & Russell* 12496.

CHIHUAHUA: Sánchez, along railway, *Hitchcock* 7691.

SINALOA: Lodiago, river bottoms, inundated in rainy seasons, *Palmer* 1648 in 1891.

DURANGO: Durango, dry ground, *Hitchcock* 7593; *Palmer* 378, 381, 539 in 1896.

Tejamén, *Palmer* 499 and 539 in 1906. Tepehuanes, *Palmer* 263 in 1906.

COAHUILA: Saltillo, rich bottom lands and gardens, *Palmer* 383 and 384 in 1898; along irrigation ditch, *Hitchcock* 5583, 5610, 5650. Jimulco Springs, *Pringle* 431.

NUEVO LEÓN: Monterey, along irrigation ditch, *Hitchcock* 5570.

TAMAULIPAS: Victoria, *Palmer* 393 and 556 in 1907. Tampico, *Palmer* 149 in 1910; among brush in low ground, *Hitchcock* 5797.

TEPIC: Santa Teresa, *Rose* 3417.

AGUASCALIENTES: Aguascalientes, weed, edge of field, *Hitchcock* 7455.

SAN LUIS POTOSÍ: Las Canóas, moist soil, *Hitchcock* 5761. San Luis Potosí, alfalfa field, *Hitchcock* 5669; *Schaffner* 149, 171. Cárdenas, moist soil, *Hitchcock* 5720; along railway, *Hitchcock* 5722.

JALISCO: San Nicolás, prairie, *Hitchcock* 7184. Zapotlán, railway right of way, *Hitchcock* 7128, 7142. Guadalajara, *Palmer* 246 and 293 in 1886. Colotlán, *Rose* 3607.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7401. Acámbaro, along railway, *Hitchcock* 6945; along road, *Hitchcock* 6953.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5821, 5849.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6712, 6726. Ixmiquilpan, *Rose, Painter & Rose* 9056. Between Pachuca and Real del Monte, *Rose, Painter & Rose* 8723.

COLIMA: Alzada, along railway, *Hitchcock* 7076; *Orcutt* 4624. Colima, moist places among thickets in fruit garden, *Palmer* 17 in 1897.

MICHOACÁN: Uruápan, in brush along railway, *Hitchcock* 6959; prairie along railway, *Hitchcock* 6986. Morelia, *Arsène* in 1909.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6898. Popo Park, open ground, *Hitchcock* 6016. Federal District, *Holway* 7, 3126, 3156; *Rose* 3556; along ditch, *Hitchcock* 5883, 5923; lava rock, *Hitchcock* 5944; lava beds, *Pringle* 6419, 11220; *Bourgeau* 231; *Orcutt* 3613, 3534.

PUEBLA: San Marcos, railway embankment, *Hitchcock* 6511. Tehuacán, along ditch, *Hitchcock* 6042. Xochimilco, *Nelson* in 1893. Chinantla, *Liebmann* 350. Acatzingo, *Nicolas* in 1909.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6320, 6327; open rocky hill, *Hitchcock* 6349, 6365, 6370; *Botteri* 157, 631, 673; *Nelson* 33. Córdoba, weed along track, *Hitchcock* 6398. Veracruz, sandy soil, *Hitchcock* 6573; sandy prairie, *Hitchcock* 6550. Jalapa, railway track, *Hitchcock* 6593, 6594, 6623; *Smith* 1547. Colipa, *Liebmann* 360. Sanborn, *Orcutt* 3237.

MORELOS: Valley of Cuantla, *Pringle* 9587. Cuernavaca, pasture, *Hitchcock* 6832. El Parque, *Orcutt* 3861.

GUERRERO: Iguala, *Rose, Painter & Rose* 9388.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

OAXACA: Oaxaca, along ditch, *Hitchcock* 6176; rocky hill, *Hitchcock* 6147, 6157. Valley of Oaxaca, *Conzatti & González* 342. Pluma, *Nelson* 2482. Las Sedas, *Smith* 935. Cuicatlán, *Nelson* 1652. Totontepec, *Nelson* 710. Tomellín, along ditch, *Hitchcock* 6210, 6223; *Rose, Painter & Rose* 10063. Without locality, *Galeotti* 5883.

CHIAPAS: Ocuilapa, table-land, *Nelson* 3023a. Turubula, *Nelson* 3336.

YUCATÁN: Izamal, *Gaumer* 756.

12. *Chaetochloa verticillata* (L.) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897.

*Panicum verticillatum* L. Sp. Pl. ed. 2. 82. 1762.

Type locality, "in Europa australi & Oriente."

RANGE: Temperate and warmer parts of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Saltillo, weed in park, *Hitchcock* 5640.

JALISCO: Guadalajara, *Palmer* 484 in 1886.

GUANAJUATO: Irapuato, weed in yard, *Hitchcock* 7438.

QUERÉTARO: Querétaro, weed in field, *Hitchcock* 5806, 5807.

PUEBLA: Tehuacán, mud of ditch, *Hitchcock* 6054; weed in field, *Hitchcock* 6064; cactus hill, *Hitchcock* 6084½.

OAXACA: Oaxaca, weed in flower pot at hotel, *Hitchcock* 6118; Valley of Oaxaca, *Pringle* 4920.

13. *Chaetochloa salzmänniana* nom. nov.

*Panicum sphaerocarpum* Salzm.; Steud. Syn. Pl. Glum. 1: 51. 1854, not Ell. 1816.

Type locality, "Bahia," Brazil.

RANGE: Southern Mexico to Brazil.

## HERBARIUM SPECIMEN FROM MEXICO.

VERACRUZ: Córdoba, base of clay bluff, *Hitchcock* 6424.

47. *IXOPHORUS* Schlecht. Linnaea 31: 421. 1862.

1. *Ixophorus unisetus* (Presl) Schlecht. Linnaea 31: 420, 747. 1862.

*Urochloa uniseta* Presl, Rel. Haenk. 1: 319. 1830.

*Ixophorus pringlei* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 6. pl. 2. 1897.

Type locality, "Mexico."

RANGE: Central western Mexico to Central America.

## HERBARIUM SPECIMENS FROM MEXICO:

TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14253.

SAN LUIS POTOSÍ: Rascón, *Purpus*, 5425.

JALISCO: Tequila, *Palmer* 372 in 1886. Valley of the Río Grande de Santiago, *Pringle* 2423, 2047.

COLIMA: Jala, common weed along railway, *Hitchcock* 7007. Alzada, along railway, *Hitchcock* 7070, 7091. Colima, low damp place, *Palmer* 141 in 1897, 1256 in 1891.

MORELOS: Cuernavaca, weed in garden, *Hitchcock* 6821; prostrate bunch in path, *Hitchcock* 6841. Valley of Cuantla, *Pringle* 8493. Trinenta, *Orcutt* 4407.

GUERRERO: Iguala, common weed in cornfield, *Hitchcock* 6695. Balsas, weed in moist soil along railway, *Hitchcock* 6805.

48. *PENNISETUM* Rich. in Pers. Syn. Pl. 1: 72. 1805.

## KEY TO THE SPECIES.

Involucral bristles about 4 cm. long; spikes oval..... 8. *P. villosum*.

Involucral bristles unequal, the longer not more than 2 cm. long;  
spikes cylindrical.

Spikelets 5 to 9 in each involucre ..... 7. *P. multiflorum*.



Spikelets solitary in each involucre.

Involucral bristles plumose ..... 6. *P. setosum*.

Involucral bristles not plumose.

Spikes 10 to 20 cm. long, the axis 1 to 3 mm. thick;  
one bristle longer and stouter than the others.

Shorter bristles few, scarcely exceeding the  
spikelets; spike stiff, the spikelets closely  
imbricated ..... 3. *P. crinitum*.

Shorter bristles numerous, about twice as long  
as the spikelet; spike more lax and loosely  
flowered ..... 5. *P. mexicanum*.

Spikes shorter, mostly less than 10 cm. long,  
rather lax, the axes slender, less than 1 mm.  
thick.

Spikes few to several; blades rarely over 1 cm.  
wide ..... 4. *P. pringlei*.

Spikes numerous; blades 3 to 5 cm. wide.

Bristles few, about as long as the spikelet,  
one elongated ..... 1. *P. tristachyum*.

Bristles numerous, all exceeding the  
spikelet ..... 2. *P. bambusiforme*.

**1. *Pennisetum tristachyum* (H. B. K.) Spreng. Syst. Veg. 1: 302. 1825.**

*Gymnothrix tristachya* H. B. K. Nov. Gen. & Sp. 1: 113. 1816.

Type locality, "prope Puembo, in humidis regni Quitensis."

RANGE: Southern Mexico to South America.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Zacuapan, open damp forests, *Purpus* 2894. Mirador, *Liebmann* 339.

Orizaba, *Botteri* 96, 631, 1209, 1214; *Seaton* 291; *Bourgeau* 2543; *Müller* 2066.

Córdoba, valley, *Bourgeau* 1664.

OAXACA: Cuicatlán, canyon, *Pringle* 5559.

**2. *Pennisetum bambusiforme* (Fourn.) Hemsl. Ind. Kew. 2: 458. 1894.<sup>1</sup>**

*Gymnothrix bambusiformis* Fourn. Mex. Pl. 2: 48. 1886.

Type locality, "in virgultis argillosis prope Mirador," the type specimen collected by Schaffner (no. 338).

RANGE: Mexico to Paraguay.

HERBARIUM SPECIMENS FROM MEXICO:

MICHOACÁN: Sierra Madre, *Langlassé* 849.

VERACRUZ: Mirador, *Liebmann* 338. Orizaba, *Botteri* 1214. Barranca of Metlac, rocky slopes, *Pringle* 6075.

OAXACA: Pluma, *Nelson* 2884. Oaxaca, *Galeotti* 5871.

**3. *Pennisetum crinitum* (H. B. K.) Spreng. Syst. Veg. 1: 302. 1825.**

*Gymnothrix crinita* H. B. K. Nov. Gen. & Sp. 1: 112. 1816.

Type locality, "in littore lacus Cuiseo, prope La Puerta de Andaracuas, et juxta S. Rosa, inter segetes, in regno Mexicano."

RANGE: Southern Mexico.

HERBARIUM SPECIMENS:

JALISCO: Río Blanco, *Palmer* 514 in 1886.

GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6936. Irapuato, moist sandy-clay plain, *Hitchcock* 7397.

<sup>1</sup> The combination is here credited to Hemsl. Biol. Centr. Amer. Bot. 3: 507. 1885, but the name is there a nomen nudum, being based on an unpublished name and without description.



## HERBARIUM SPECIMENS—Continued.

MICHOACÁN: Pátzcuaro, *Rose* 3629. Morelia, wet meadows, *Pringle* 4316; *Rose* 3593; *Arsène* in 1909.

MÉXICO: Lechería, low lands, *Pringle* 13251.

4. *Pennisetum pringlei* Leake, Zeitschr. Naturw. 79: 33. 1907.

RANGE: Pacific slope of Mexico.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Potrero Mountains, under ledges, *Pringle* 817.

OAXACA: Sierra de San Felipe, *Conzatti & González* 491; dry banks, *Pringle* 4962.

5. *Pennisetum mexicanum* (Fourn.) Hemsl. Ind. Kew. 2: 508. 1894.<sup>1</sup>

*Gymnothrrix mexicana* Fourn. Mex. Pl. 2: 48. 1886.

Type locality, "Orizaba," the following specimens being cited: *Bourgeau* 3139, *Schaffner* 105, 174, *Thomas* in herb. *Buchinger*, *F. Müller* 2015, *Botteri* 143, 1486; an additional locality, Papantla (*Liebmann* 344), also cited.

RANGE: Eastern slope of Mexico.

## HERBARIUM SPECIMENS:

VERACRUZ: Orizaba, *Bourgeau* 3139; open rocky hill, *Hitchcock* 6356; *Smith* 625.

6. *Pennisetum setosum* (Swartz) Rich. in Pers. Syn. Pl. 1: 72. 1805.

*Cenchrus setosus* Swartz, Prodr. Veg. Ind. Occ. 26. 1788.

Type locality, "India occidentalis."

RANGE: Mexico and West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, damp places, *Pringle* 1740. Tequila, hills, *Pringle* 4618. Río Blanco, *Palmer* 677 in 1886.

COLIMA: Colima, *Palmer* 1269 in 1891. Alzada, rocky hillside, *Hitchcock* 7080; along railway, *Hitchcock* 7094.

VERACRUZ: Zacuapan, rocky hills, *Purpus* 2154. Jalapa, along railway, *Hitchcock* 6544. Orizaba, roadside ditch, *Hitchcock* 6343.

MORELOS: Cuernavaca, *Pringle* 11241.

GUERRERO: Between Petatlán and Chilapa, *Nelson* 2149. Acapulco, *Palmer* 433 in 1895.

OAXACA: Trapiche de la Concepción, *Liebmann* 336, 342. Oaxaca, along ditch, *Hitchcock* 6187.

CHIAPAS: Tuxtla, *Nelson* 3090.

7. *Pennisetum multiflorum* Fourn. Mex. Pl. 2: 49. 1886.

Type locality, Mexico, Fournier citing no localities or specimens.

RANGE: Pacific slope of Mexico and Costa Rica.

## HERBARIUM SPECIMENS:

SONORA: Alamos, *Rose*, *Standley & Russell* 12866.

JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7342, 7364; wet canyons, *Pringle* 2044; wet slopes of barranca, *Pringle* 3849, 11327; *Holway* 3 in 1896.

GUERRERO: Balsas, rocky hill, *Hitchcock* 6791. Acapulco, *Palmer* 75 in 1895.

OAXACA: Oaxaca, *Galeotti* 5880. San Agustín, *Liebmann* 341.

CHIAPAS: Roadside between San Ricardo and Ocozocuahtla, *Nelson* 2985; tableland about Ocuilapa, *Nelson* 3065.

8. *Pennisetum villosum* R. Br. in Fres. Mus. Senckenb. Abh. 2: 134. 1837.

Type locality, Abyssinia.

RANGE: Warmer parts of the Old World, sparingly introduced in California and Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

SINALOA: Topolobampo, near water ditch, *Palmer* 231 in 1897.

<sup>1</sup> See footnote, p. 181.



49. **CENCHRUS** L. Sp. Pl. 1049. 1753.

SAND BUR. BUR GRASS.

## KEY TO THE SPECIES.

- Bristles of bur barbed forwards..... 2. *C. pallidus*.  
 Bristles of bur barbed backwards.  
   Plants perennial; culms woody; spikes long and slender. .... 1. *C. myosuroides*.  
   Plants annual.  
     Bristles at base of bur numerous.  
       Burs loosely arranged, rather few; spikes usually less than 5 cm. long..... 5. *C. insularis*.  
       Burs numerous, compactly arranged; spikes often more than 5 cm. long.  
         Burs about 4 mm. wide; spikes narrowed at the summit..... 3. *C. viridis*.  
         Burs about 6 mm. wide; spikes obtuse at the summit..... 4. *C. echinatus*.  
     Bristles at base of bur few or none.  
       Burs large, 1 to 1.5 cm. wide, the spines often exceeding 1 cm. in length..... 8. *C. palmeri*.  
       Burs medium size or small.  
         Burs medium size, loosely arranged; spines slender..... 7. *C. carolinianus*.  
         Burs small, compactly arranged, the spikes slender; spines short, usually less than 3 mm. long..... 6. *C. pauciflorus*.

1. **Cenchrus myosuroides** H. B. K. Nov. Gen. & Sp. 1: 115. *pl.* 35. 1816.

Type locality, "in arenosis, apricis insulae Cayo Flamingo prope portum Cubensem, Batabano," the species also recorded from Patibilca, Peru.

RANGE: Florida, Mexico, and the West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Comondú, *Brandegge* in 1889.

SONORA: Hermosillo, bank of ditch, *Hitchcock* 3611; along irrigating ditch, *Rose*, *Standley & Russell* 12484. Guaymas, *Palmer* 327 in 1887. Yaqui River, *Palmer* 10 in 1869.

CHIHUAHUA: Chihuahua, watercourses, *Wilkinson* in 1885; wet places, *Pringle* 429.

DURANGO: Durango, along a garden wall and beside water ditches, *Palmer* 868 in 1896; prairie along creek, *Hitchcock* 7614. Torreón, along ditch, *Hitchcock* 7560.

COAHUILA: Saltillo, dry mesa, *Hitchcock* 5647.

ZACATECAS: San Juan Capistrano, *Rose* 2453.

AGUASCALIENTES: Aguascalientes, weed, edge of field, *Hitchcock* 7450.

JALISCO: Guadalajara, *Palmer* 765 in 1886.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7402.

HIDALGO: Dublán, valley, *Pringle* 9598.

COLIMA: Revillagigedo Islands, San Benedicto Island, *Anthony* 370; *Barkewlew* 171; Socorro Island, *Barkewlew* 202.

MICHOACÁN: El Tibor, prairies, *Langlassé* 290.

PUEBLA: Tehuacán, old field, *Hitchcock* 6035.

OAXACA: Oaxaca, along ditch, *Hitchcock* 6131. Tomellín, rocky bank by river, *Hitchcock* 6199.



**2. *Cenchrus pallidus* Fourn. Mex. Pl. 2: 50. 1886.**

Type locality, "In locis ruderalis, Hacienda de Santa Cruz pr. Tehuantepec in prov. Oajacensi," the type specimen collected by Liebmann (no. 465).

RANGE: Southern Mexico to South America.

**HERBARIUM SPECIMENS FROM MEXICO:**

COLIMA: Jala, along railway, *Hitchcock* 7050.

MORELOS: Yautepec, lava fields, *Pringle* 11219.

GUERRERO: Balsas, low moist ground, edge of field, *Hitchcock* 7840. Iguala, by streams, *Pringle* 8394.

OAXACA: Hacienda de Santa Cruz, *Liebmann* 465. Tomellín, along track, *Hitchcock* 6217. Oaxaca, *Galeotti* 5880.

**3. *Cenchrus viridis* Spreng. Syst. Veg. 1: 301. 1825.**

Type locality, "Guadalupa."

RANGE: Florida to Central America and the West Indies.

**HERBARIUM SPECIMENS FROM MEXICO:**

TAMAULIPAS: Tampico, *Palmer* 155 in 1910.

COLIMA: Jala, along railway, *Hitchcock* 7008. Manzanillo, *Palmer* 1086 in 1890; base of rocky cliff near seashore, *Hitchcock* 7043. Paso del Río, *Emrick* 6.

PUEBLA: Puebla, *Nicolas* in 1908.

VERACRUZ: Veracruz, low place in sandy prairie, *Hitchcock* 6579. Orizaba, *Seaton* 51. Sanborn, *Orcutt* 3074.

OAXACA: Cuicatlán, *Nelson* 1653.

TABASCO: Without locality, *Rovirosa* 477.

YUCATÁN: Mérida, *Schott* 498. Progreso, *Millsbaugh* 1682.

**4. *Cenchrus echinatus* L. Sp. Pl. 1050. 1753.**

Type locality given as "In Jamaica [et] Curassao," the type specimen probably from the first-named island.

RANGE: Warmer parts of America.

**HERBARIUM SPECIMENS FROM MEXICO:**

LOWER CALIFORNIA: Comondú, *Brandegge* in 1889.

SONORA: Guaymas, *Palmer* in 1887. Alamos, *Rose, Standley & Russell* 13029. Hermosillo, valley of Río de Sonora, *Rose, Standley & Russell* 12495; in meadow along ditch, *Hitchcock* 3602.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 22 in 1885.

SINALOA: Mazatlán, dry hill, *Rose, Standley & Russell* 13674. Rosario, *Rose* 3110.

DURANGO: Durango, dry ground, *Hitchcock* 7607; in graveyard and in mesquite bottoms, *Palmer* 880 in 1896. Torreón, weed in field, *Hitchcock* 7558.

COAHUILA: Monclova, *Palmer* in 1880.

NUEVO LEÓN: Monterey, moist sand along river, *Hitchcock* 5556.

TAMAULIPAS: Tampico, grass land along railway, *Hitchcock* 5786. Victoria, *Palmer* 83 in 1907.

AGUASCALIENTES: Aguascalientes, weed, edge of field, *Hitchcock* 7439; weed in cornfield, *Hitchcock* 7490.

SAN LUIS POTOSÍ: Cárdenas, irrigated field, *Hitchcock* 5751.

JALISCO: Guadalajara, prairie near San Pedro, *Hitchcock* 7293. San Nicolás, cornfield, *Hitchcock* 7219. Zapotlán, railway right of way, *Hitchcock* 7124. La Junta, along railway, *Hitchcock* 7001. Colotlán, *Rose* 3603. Chapala, *Rose & Painter* 7623.

GUANAJUATO: Irapuato, moist, sandy-clay plain, *Hitchcock* 7405.

QUÉRETARO: Querétaro, weed in park, *Hitchcock* 5841.

COLIMA: Alzada, along railway, *Hitchcock* 7100. Manzanillo, base of rocky cliff near shore, *Hitchcock* 7043½.

MICHOACÁN: Uruápan, along railway, *Hitchcock* 6988.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

PUEBLA: Tehuacán, bottom-land field, *Hitchcock* 6076.

VERACRUZ: Orizaba, *Bourgeau* 3140. Veracruz, sandy prairie, *Hitchcock* 6556; sandy beach, *Hitchcock* 6571. Jalapa, along railway, *Hitchcock* 6629. Mirador, *Ross* 644.

MORELOS: Cuernavaca, weed along railway, *Hitchcock* 6876; weed in garden, *Hitchcock* 6852.

GUERRERO: Santa Fé, along railway, *Hitchcock* 6690. Balsas, open woods on hill, *Hitchcock* 6787.

OAXACA: Oaxaca, sandy soil along railway, *Hitchcock* 6127. Tomellín, rocky bank by river, *Hitchcock* 6198; weed in cornfield, *Hitchcock* 6247.

YUCATÁN: Progreso, *Millspaugh* 1698.

5. *Cenchrus insularis* Scribn. in Millsp. Field Mus. Bot. 2: 26. 1900.

Type locality, "Pajaros Island, Alacrán Shoals," the type specimen collected by Millspaugh (Pl. Uto. no. 1759).

RANGE: Pacific slope of Mexico and off the coast of Yucatán.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Purpus* 320.

SONORA: Yaqui River, *Palmer* 12 in 1869. Alamos, in an orchard, *Rose, Standley & Russell* 13019.

SINALOA: Topolobampo, *Rose, Standley & Russell* 13280. Fuerte, in river valley, *Rose, Standley & Russell* 13561.

JALISCO: Guadalajara, *Safford* 1390.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5861.

YUCATÁN: Alacrán Shoals, *Millspaugh* Pl. Uto. 1759.

6. *Cenchrus pauciflorus* Benth. Bot. Voy. Sulph. 56. 1840.

Type locality, "Bay of Magdalena."

RANGE: Western Mexico.

## HERBARIUM SPECIMENS:

LOWER CALIFORNIA: San José del Cabo, *Brandeggee* in 1890. Boca de las Animas, *Brandeggee* in 1889.

COLIMA: Armería, along railway, *Hitchcock* 7047.

7. *Cenchrus carolinianus* Walt. Fl. Carol. 79. 1788.

Type locality, presumably South Carolina.

RANGE: Northern United States to Central America and the West Indies.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Agueda, *Palmer* 220 in 1890.

SONORA: Hermosillo, rocky border, dry bed of Sonora River, *Chase* 5500; by ditch in meadow, *Hitchcock* 3578. Sierra de Alamos, *Rose, Standley & Russell* 12837. Guaymas, island in harbor, *Rose, Standley & Russell* 15019; *Palmer* 168 and 349 in 1887.

CHIHUAHUA: Chihuahua, weed in old field, *Hitchcock* 7788. Casas Grandes, *Nelson* 6327.

SINALOA: Mazatlán, dry hill, *Rose, Standley & Russell* 13794.

DURANGO: Durango, west slope of Iron Mountain, *Palmer* 196 in 1896; dry ground, *Hitchcock* 7575. Torreón, weed in field, *Hitchcock* 7559.

COAHUILA: Jaral, *Schumann* 1730. Saltillo, sandy field, river bottom, *Hitchcock* 5628.

NUEVO LEÓN: Monterey, stony bed of river, *Hitchcock* 5523.

TAMAULIPAS: Victoria, *Palmer* 396 in 1907. Tampico, *Palmer* 156 in 1910; sand dunes, *Hitchcock* 5792.

TEPIC: Acaponeta, along the river, *Rose, Standley & Russell* 14407.

AGUASCALIENTES: Aguascalientes, weed along road, *Hitchcock* 7440; sterile rocky hill, *Hitchcock* 7470.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 167; irrigated field, *Hitchcock* 5699; field, *Hitchcock* 5654. Cárdenas, along railway track, *Hitchcock* 5733.

JALISCO: Guadalajara, prairie near San Pedro, *Hitchcock* 7292. Tecomán, *Orcutt* 4446.

QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5825.

HIDALGO: Tula, limestone hills, *Rose, Painter & Rose* 8361.

COLIMA: Manzanillo, along railway, *Hitchcock* 7049. Armería, sandy soil, *Hitchcock* 7023.

MÉXICO: Popo Park, *Hitchcock* 6688½; open ground, *Hitchcock* 6025.

PUEBLA: Tehuacán, *Seler* 7; along railway, *Hitchcock* 6045; bottom land of river, *Hitchcock* 6068½. San Cristo, *Nicolas* in 1909.

VERACRUZ: Veracruz, sandy beach, *Hitchcock* 6575. Orizaba, roadside ditch, *Hitchcock* 6339.

GUERRERO: Acapulco, *Palmer* 290 in 1894.

OAXACA: Tomellín, rocky soil, *Hitchcock* 6204; along railway track, *Hitchcock* 6218, 6249. Oaxaca, sandy soil along railway, *Hitchcock* 6128. Valley of Oaxaca, *Nelson* 1291. Santa Catarina Canyon, *Pringle & Conzatti* 274.

QUINTANA ROO: Cozumel, east shore, *Millsbaugh* 1607.

**8. *Cenchrus palmeri*** Vasey in T. S. Brandeg. Proc. Calif. Acad. II. 2: 211. 1889.

Type locality, "Guaymas, Mex.," the type specimen collected by Palmer in 1887 (no. 689).

RANGE: Northwestern Mexico.

## HERBARIUM SPECIMENS:

LOWER CALIFORNIA: San José del Cabo, *Purpus* 519. Magdalena Bay, *Brandeg* in 1889. Carmen Island, *Palmer* 14 in 1870, 865 in 1890. Calmallí, *Orcutt* in 1899.

SONORA: Guaymas, *Palmer* 271 and 689 in 1887. Adair Bay, sand hills, *Sykes* 58.

**50. *STENOTAPHRUM*** Trin. Fund. Agrost. 175. 1820.

**1. *Stenotaphrum secundatum*** (Walt.) Kuntze, Rev. Gen. Pl. 2: 794. 1891.

ST. AUGUSTINE GRASS.

*Ischaemum secundatum* Walt. Fl. Carol. 249. 1788.

Type locality, presumably South Carolina.

RANGE: Southern United States and West Indies to South America.

## HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Veracruz, *Müller* 2180.

**51. *OLYRA*** L. Syst. Nat. ed. 10. 1261. 1759.

**1. *Olyra latifolia*** L. Syst. Nat. ed. 10. 1261. 1759.

Type locality, Jamaica, the type specimen collected by Browne.

RANGE: Mexico and West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Micos, *Pringle* 3795.

MICHOACÁN: La Correa, *Langlassé* 373.

VERACRUZ: Jicaltepec, *Liebmann* 259. Isthmus of Tehuantepec, *Ross* 1100. Misantla, *Purpus* 5976.

OAXACA: Lacoba, *Liebmann* 264.

TABASCO: Atasta, Arroyo de Tapijuluya, *Rovirosa* 43.



**52. LITHACHNE** Beauv. Ess. Agrost. 135. *pl.* 24. *f.* 11. 1812.

1. **Lithachne pauciflora** (Swartz) Beauv.; Poir. Dict. Sci. Nat. 27: 60. 1823.

*Olyra pauciflora* Swartz, Prodr. Veg. Ind. Occ. 21. 1788.

Type locality, "Jamaica."

RANGE: Mexico, Central America, and West Indies.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Colipa, *Liebmann* 269. Córdoba, *Hitchcock* 6447. Zacuapan, *Purpus* 6221.

**53. RADDIA** Bertol. Opusc. Sci. Bologna 3: 410. 1819.

1. **Raddia strictiflora** (Fourn.) Chase, Proc. Biol. Soc. Washington 21: 185. 1908.

*Strephium strictiflorum* Fourn. Bull. Soc. Bot. Belg. 15: 465. 1876.

Type locality, "Arroyo Selloero," Mexico, the type specimen collected by Karwinsky (no. 1473).

RANGE: Gulf region of Mexico.

HERBARIUM SPECIMENS:

VERACRUZ: Lacoba, *Liebmann* 264 in part. Hacienda de Jovo, *Liebmann* 267.

**54. PHARUS** L. Syst. Nat. ed. 10. 1269. 1759.

## KEY TO THE SPECIES.

- Culms erect..... 1. *P. glaber*.  
Culms creeping at base and rooting at the nodes..... 2. *P. parvifolius*.

1. **Pharus glaber** H. B. K. Nov. Gen. & Sp. 1: 196. 1816.

Type locality, "in temperatis, opacatis Provinciae Novae Andalusiae, prope coenobium Caripense."

RANGE: Mexico and West Indies to South America.

HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: Barranca of Las Canoás, rich woods, *Pringle* 3990.

VERACRUZ: Mirador, *Liebmann* 258. Zacuapan, *Purpus* 6214.

2. **Pharus parvifolius** Nash, Bull. Torrey Club 35: 301. 1908.

Type locality, "Les Roches, a few miles to the west of Plaisance, Haiti," the type specimen collected by Nash and Taylor (no. 1482).

RANGE: Veracruz, West Indies, and Central America.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Sanborn, *Orcutt* 3236.

**55. LUZIOLA** Gmel. Syst. Nat. 636. 1791.

1. **Luziola peruviana** Gmel. Syst. Nat. 637. 1791.

Type locality, Peru.

RANGE: Mexico to Uruguay.

HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, shallow water, *Pringle* 3867.

MÉXICO: Tlalnepantla, wet places, *Pringle* 11227.

TABASCO: Bank of González River, *Rovirosa* 555.

**56. HOMALOCENCHRUS** Mieg. Act. Helv. Phys.-Math. 4: 307. 1760.

## KEY TO THE SPECIES.

- Panicle contracted, the branches ascending, spikelet-bearing from  
near the base..... 1. *H. hexandrus*.  
Panicle open, the branches slender, spreading, 10 cm. or more  
long, naked below.



- Ligule short, about 1 mm. long..... 2. *H. grandiflorus*.  
 Ligule conspicuous, as much as 1 cm. long ..... 3. *H. ligularis*.

1. **Homalocenchrus hexandrus** (Swartz) Kuntze, Rev. Gen. Pl. 2: 777. 1891.

*Leersia hexandra* Swartz, Prodr. Veg. Ind. Occ. 21. 1788.

Type locality, "Jamaica."

RANGE: Southern United States, Mexico, and West Indies to South America.

HERBARIUM SPECIMENS FROM MEXICO.

DURANGO: Durango, in pond, *Hitchcock* 7570; gravel of dry creek bed, *Hitchcock* 7612; *Palmer* 195 in 1896.

JALISCO: Guadalajara, *Palmer* 244 in 1886. Orozco, border of large pond, *Hitchcock* 7383.

GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6929.

MICHOACÁN: Lake Pátzcuaro, shallows, *Pringle* 3330.

MÉXICO: Tlalnepantla, in shallow water, *Pringle* 11226.

FEDERAL DISTRICT: Azcapotzalco, water of ditch, *Hitchcock* 5922. Churubusco, *Orcutt* 4279.

PUEBLA: Puebla, *Nicolas* in 1908 and 1910.

VERACRUZ: Córdoba, in water along railway, *Hitchcock* 6432.

MORELOS: Cuernavaca, ditch, *Hitchcock* 6847.

OAXACA: Oaxaca, water of ditch, *Hitchcock* 6174.

TABASCO: Atasta, *Rovirosa* 648.

2. **Homalocenchrus grandiflorus** (Doell).

*Oryza monandra* var. *grandiflora* Doell in Mart. Fl. Bras. 2<sup>2</sup>: 9. 1871.

Type locality, "ad Caldas in prov. Minarum," Brazil, the type specimen collected by Regnall (no. III. 1402).

RANGE: Veracruz to South America.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Mirador, *Liebmann* 256. Córdoba, shady bank, *Hitchcock* 6480.

3. **Homalocenchrus ligularis** (Trin.) Kuntze, Rev. Gen. Pl. 2: 777. 1891.

*Leersia ligularis* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3<sup>1</sup>: 168. 1840.

Type locality, "Mexico, prope Jalapam, in sylvis montis Macultepec," the type specimen collected by Schiede.

RANGE: Veracruz.

HERBARIUM SPECIMENS:

VERACRUZ: Jalapa, rich soil along railway through timber, *Hitchcock* 6619. Orizaba, open rocky hill, *Hitchcock* 6378; in woods near top of rocky hill, *Hitchcock* 6382.

57. **PHALARIS** L. Sp. Pl. 54. 1753.

KEY TO THE SPECIES.

- Glumes narrowly winged; panicle oblong..... 1. *P. caroliniana*.  
 Glumes broadly winged; panicle ovate or ovate-oblong.  
     Sterile lemma solitary; fertile lemma 3 mm. long..... 2. *P. minor*.  
     Sterile lemmas in pairs; fertile lemma 5 to 6 mm. long..... 3. *P. canariensis*.

1. **Phalaris caroliniana** Walt. Fl. Carol. 74. 1788.

Type locality, presumably South Carolina.

RANGE: Southern United States to northern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Magdalena, *Rose, Standley & Rose* 15078.

CHIHUAHUA: Chihuahua, *Palmer* 32 in 1908.

2. **Phalaris minor** Retz. Obs. Bot. 3: 8. 1783.

Type locality, East Indies, particular locality not given.



RANGE: Temperate and warmer regions of the Old World, adventive from northern United States to Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

MÉXICO: Tlalnepantla, wet meadow, *Rose, Painter & Rose* 8384. Federal District, Tacubaya, *Bourgeau* 221.

3. *Phalaris canariensis* L. Sp. Pl. 54. 1753.

CANARY GRASS.

Type locality, "Canariis."

RANGE: Warmer parts of the Old World, introduced in the Western Hemisphere.

HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Rosario, *Rose* in 1897.

NUEVO LEÓN: Monterey, fields, *Dodge* in 1891.

FEDERAL DISTRICT: San Angel, *Orcutt* 3695.

58. *SAVASTANA* Schrank, Baier. Fl. 1: 100, 337. 1789.

1. *Savastana mexicana* (Rupr.) Beal, Grasses N. Amer. 2: 187. 1896.

*Ataxia mexicana* Rupr.; Fourn. Mex. Pl. 2: 71. 1886.

Type locality, "Cerro San Felipe," Oaxaca, the type specimen collected by Galeotti (no. 5756).

RANGE: Known only from the type locality.

HERBARIUM SPECIMENS:

OAXACA: Sierra de San Felipe, dry ridges under pines, *Pringle* 4700; *Smith* 940; *Conzatti & González* 420. Summit of Zempoaltepec, *Nelson* 624.

59. *ARISTIDA* L. Sp. Pl. 82. 1753.

KEY TO THE SPECIES.

Lateral awns short or none.

Plants annual; awn not twisted, flexuous; branchlets sparsely

long-pilose ..... 1. *A. jorullensis*.

Plants perennial.

Awns twisted at neck ..... 2. *A. schiedeana*.

Awns not twisted.

Awns recurved ..... 3. *A. purpusiana*.

Awns straight or flexuous ..... 4. *A. scabra*.

Lateral awns at least half as long as the central one.

Neck of fruit jointed at base, long and slender, twisted.

Plants perennial; glumes unequal, awnless ..... 6. *A. californica*.

Plants annual; glumes equal, awn-pointed ..... 5. *A. tuberculosa*.

Neck of fruit not jointed.

Plants annual, mostly low and spreading; panicle narrow and rather dense ..... 7. *A. bromoides*.

Plants perennial.

Culms and sheaths lanate-pubescent ..... 8. *A. lanuginosa*.

Culms glabrous.

Neck of awns twisted.

Branches of panicle long, naked below.

Panicle branches stiffly divergent; blades involute, mostly less than 10 cm.

long; culms 20 to 40 cm. high .... 9. *A. palmeri*.

Panicle branches more or less flexuous;

blades elongated, flat below, involute at tip; culms often as

much as 1 meter high ..... 10. *A. longiramea*.



Branches of panicle short, erect, some flower-bearing branchlets near the base.

Blades flat . . . . . 11. *A. spadicea*.

Blades involute . . . . . 12. *A. arizonica*.

Neck of awns not twisted.

Panicle open, the branches divaricately spreading or reflexed, naked below . . . 13. *A. divaricata*.

Panicle contracted, the main branches not stiffly spreading or divaricate.

First glume slightly longer than the second . . . . . 14. *A. liebmanni*.

First glume shorter than the second.

Panicle branches capillary, flexuous.

Panicle narrow, only the main branches flexuous; leaves mostly basal . . . . . 15. *A. berlandieri*.

Panicle rather diffuse, all the branches flexuous; leaves scattered . . . . . 16. *A. micrantha*.

Panicle branches short, stiff, ascending.

First glume slightly shorter than the second; panicle virgate; blades elongated, more or less scattered . . . . . 17. *A. wrightii*.

First glume about half as long as the second; panicle few-flowered, not virgate; leaves mostly basal.

Awns 4 to 6 cm. long . . . . . 18. *A. fendleriana*.

Awns about 10 cm. long . . . . . 19. *A. longiseta*.

**1. *Aristida jorullensis* Kunth, Rév. Gram. 1: 62. 1829.**

Type locality, "in planitie calidissima Mexicana, Playas de Jorulla."

RANGE: Pacific slope of Mexico and Central America.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Alamos, rocky hillside, *Rose, Standley & Russell* 12756.

SINALOA: Mazatlán, dry hill, *Rose, Standley & Russell* 13681. Culiacán, Cerro Colorado, *Brandegge* in 1904.

TEPIC: Acaponeta, dry hill, *Rose, Standley & Russell* 14303.

COLIMA: Manzanillo, *Palmer* 1084 in 1890. Tecomán, along railway, *Hitchcock* 7048. Alzada, gravelly soil, *Hitchcock* 7075. Colima, *Orcutt* 4569.

GUERRERO: Acapulco, *Palmer* 36 in 1894.

**2. *Aristida schiedeana* Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3<sup>1</sup>: 120. 1840.**

*Aristida orcuttiana* Vasey, Bull. Torrey Club 13: 27. 1886.

Type locality, "Mexico, prope Jalapam," the type specimen collected by Schiede (no. 909).

RANGE: Southwestern United States to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: La Chuparosa, *Brandegge* in 1897. Sierra de San Francisco, *Brandegge* in 1899. Hansen's ranch, *Orcutt* 507.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

- CHIHUAHUA: Sánchez, rocky pine woods, *Hitchcock* 7671. Miñaca, rocky hill, *Hitchcock* 7763. Santa Eulalia Mountains, *Pringle* 386; *Wilkinson* 4, 343. Sierra Madre, *Nelson* 6496a.
- DURANGO: Durango, rocky hill, *Hitchcock* 7588.
- ZACATECAS: Plateado; *Rose* 2793.
- JALISCO: Río Blanco, *Palmer* 769 and 769a in 1886.
- HIDALGO: Pachuca, rocky hill, *Hitchcock* 6752.
- MICHOACÁN: Uruápan, prairie, *Hitchcock* 6975.
- MÉXICO: Popo Park, edge of woods, *Hitchcock* 5971. Federal District, *Orcutt* 3732.
- PUEBLA: Esperanza, rocky hill, *Hitchcock* 6480. Cerro de Chicamole, *Purpus* 4218. San Marcos, railway embankment, *Hitchcock* 6526, 6539. Chalchicomula, rocky hill, *Hitchcock* 6273, 6299. Without locality, *Purpus* 4221.
- MORELOS: Alarcón, *Orcutt* 3863.
- OAXACA: Sierra de San Felipe, *Conzatti & González* 439. Near Reyes, *Nelson* 1807.

3. *Aristida purpusiana* sp. nov.

Perennial; culms erect, slender, rigid, glabrous, 50 to 60 cm. high, the branches stiffly ascending; sheaths glabrous, pilose at the throat; blades 1 to 2 mm. wide, 5 to 10 cm. long, becoming involute; panicle narrowly pyramidal, 15 to 25 cm. long; branches few, short, few-flowered, finally spreading or reflexed, the lower 5 to 6 cm. long, the branchlets and pedicels stiffly ascending; glumes somewhat unequal, the lower about 6 mm., the upper 8 mm. long, smooth, 1-nerved, slightly notched at the apex; lemma conspicuously pilose at the base, about 1 cm. long to base of awns, straight, minutely scabrous on the short beak; lateral awns scarcely 1 mm. long; terminal awn about 8 mm. long, recurved by a semicircular bend.

Type in the U. S. National Herbarium, no. 470407, collected at San José del Cabo, Lower California, Mexico, in 1901, by C. A. Purpus (no. 394).

The only other specimen observed was collected at the same place in 1890 by T. S. Brandegee.

4. *Aristida scabra* (H. B. K.) Kunth, Rév. Gram. 1: 62. 1829.

*Streptachne scabra* H. B. K. Nov. Gen. & Sp. 1: 124. pl. 40. 1816.

Type locality, "in frigidis montanis regni Mexicani juxta Toluca et Islahuaca."

RANGE: Southern United States, Mexico and West Indies to Panama.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Benorana (Cape Region), *Brandegee* in 1899. San José del Cabo, *Brandegee* in 1890 and 1899. San Francisquito Mountains, *Brandegee* in 1890.

SONORA: Alamos, *Palmer* 702 in 1890. Hermosillo, dry soil, *Hitchcock* 3537; meadow near river, *Hitchcock* 3596; rocky cliff, *Hitchcock* 3603. Guaymas, *Palmer* 55 and 268 in 1887; rocky lava hill, *Hitchcock* 3545; dry hills, *Rose, Standley & Russell* 12607.

CHIHUAHUA: Santa Eulalia Plains, *Wilkinson* in 1885. Southwestern Chihuahua, *Palmer* 115 and 161 in 1885. Rocky hills near Chihuahua, *Pringle* 387, *Hitchcock* 7789.

SINALOA: Culiacán, *Rose, Standley & Russell* 14986. Fuerte, dry hills, *Rose, Standley & Russell* 13511. Lodiago, common in mountains, *Palmer* 1653 in 1891.

DURANGO: Santiago Papasquiario, *Palmer* 472 in 1896.

SAN LUIS POTOSÍ: Las Palmas, limestone hills, *Pringle* 3776.

JALISCO: San Nicolás, sterile clay hill, *Hitchcock* 7209; Bolaños, *Rose* 3694.

GUANAJUATO: Irapuato, dry shrubby hill, *Hitchcock* 7428.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

COLIMA: Manzanillo, *Palmer* 1091 in 1890; *Orcutt* 4463, rocky cliff, *Hitchcock* 7038. Alzada, *Orcutt* 4633.

PUEBLA: Tehuacán, cactus hill, *Hitchcock* 6093, 6094. Río de San Francisco, *Purpus* 4217, 4219.

VERACRUZ: Camarón, *Rose & Rose* 11453.

MORELOS: Cuernavaca, rocky hill, *Hitchcock* 6831, 6872; in barranca, *Rose, Painter & Rose* 10227, *Pringle* 6496.

GUERRERO: Balsas, rocky hill, *Hitchcock* 6785; in gravel along railway, *Hitchcock* 6798.

OAXACA: Oaxaca, hills, *Pringle* 4857; rocky hill, *Hitchcock* 6137, 6142, 6151, 6161; side of sterile rocky hill among cactus, *Hitchcock* 6100. Tomellín, on rocks along track, *Hitchcock* 6219; rocky hill, *Hitchcock* 6203.

YUCATÁN: Izamal, *Gaumer* 1024.

5. *Aristida tuberculosa* Nutt. Gen. Pl. 1: 57. 1818.

Type locality, "in the sandy pine forests of Georgia, a few miles from Augusta."

RANGE: Throughout eastern United States, and in Puebla, Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

PUEBLA: Puebla, dry hills, *Nicolas* in 1908.

6. *Aristida californica* Thurb. in S. Wats. Bot. Calif. 2: 289. 1880.

Type locality, California, the original specimens cited being "Colorado Desert (*Schott*); Fort Mohave, *Cooper*."

RANGE: Southern California and Arizona and northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Los Angeles Bay, *Palmer* 501 in 1887. Socorro, *Orcutt* 1443, 1444. San José del Cabo, *Brandeggee* in 1889, in 1890, in 1893; *Purpus* 311, Lagoon Head, *Palmer* 654 in 1889. Santo Domingo, *Orcutt* in 1899. Calmallí, plains, *Purpus* 63; *Orcutt* in 1899. La Paz, *Palmer* 129 in 1890.

SONORA: Guaymas, *Palmer* 501 in 1887. MacDougal Pass, Pinacate Mountains. *MacDougal* 32.

7. *Aristida bromoides* H.B.K. Nov. Gen. & Sp. 1: 122. 1816.

Type locality, "in montanis regni Quitensis juxta Tambo de Guamote et Llanos de Tiocaxes."

RANGE: Southwestern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Calmallí, plains, *Purpus* 231; *Orcutt* in 1899. Carmen Island, *Palmer* 858 in 1890. Santa Gertrudis, *Orcutt* in 1899. Indian Wells, gravelly mesas, *Orcutt* 2033. Volcán de las Tres Vírgenes, *Orcutt* in 1899. San José del Cabo, *Brandeggee* in 1890. San Julio, *Brandeggee* in 1889. Sierra de San Francisquito, *Brandeggee* in 1899. La Paz, *Palmer* in 1890. Lagoon Head, *Palmer* 651 in 1889. Los Angeles Bay, *Palmer* 503 and 504 in 1887. Cedros Island, *Palmer* 665 in 1889. Guadalupe Island, *Palmer* 669 and 675 in 1889. Santa Rosalía, *Palmer* 270 in 1890. Signal Mountain, *Schoenfeldt* 2951.

SONORA: Guadalupe Canyon, *Merton* 2033. Yaqui River, *Palmer* 2 in 1869. Alamos, along an arroyo, *Rose, Standley & Russell* 12699. Guaymas, *Palmer* 273 in 1890, 66, 503, and 504 in 1887; rocky soil, *Hitchcock* 3555; *Maltby* 197. Hermosillo, dry soil, *Hitchcock* 3540; meadow near river, *Hitchcock* 3589. Llano, along railway, *Hitchcock* 3529. Quitovaquito, *MacDougal* in 1907.

CHIHUAHUA: Chihuahua, rocky hills, *Pringle* 390; *Hitchcock* 7796. Miñaca, rocky hill by dry run, *Hitchcock* 7755. Sierra en Media, *Nelson* 6466. Between Casas Grandes and Sabinal, *Nelson* 6369.

SINALOA: Fuerte, dry hills, *Rose, Standley & Russell* 13521. Topolobampo, *Rose, Standley & Russell* 13269.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

**DURANGO:** Durango, common on hillsides and plains, especially among ant hills, *Palmer* 535 in 1896; among mesquite bushes, *Palmer* 767 in 1896; along road, *Hitchcock* 7581; dry ground, *Hitchcock* 7602. Tlahualilo, *Pittier* 469. Torreón, *Holway* 16½; rocky hill, *Hitchcock* 7544.

**HIDALGO:** Dublán, *Pringle* 9597. Pachuca, rocky hill, *Hitchcock* 6727. Telles, *Orcutt* 4130.

**FEDERAL DISTRICT:** Pedregal, lava rock, *Hitchcock* 5937; dry soil, *Pringle* 6227; *Schaffner* 164; *Rose & Painter* in 1903.

**PUEBLA:** Tehuacán, along railway, *Hitchcock* 6048½; edge of field in dry ditch, *Hitchcock* 6075.

**MORELOS:** Cuernavaca, along stone wall, *Hitchcock* 6865.

**OAXACA:** Oaxaca, side of sterile rocky hill, among cactus, *Hitchcock* 6100½; rocky hill, *Hitchcock* 6138; edge of field, *Hitchcock* 6165. Cuicatlán, *Nelson* 1654. Tomellín, *Rose, Painter & Rose* 10086; rocky bank, *Hitchcock* 6194. Las Sedas, *Smith* 918, 931.

**COAHUILA:** Saltillo, *Palmer* 333 in 1904; sandy field, river bottom, *Hitchcock* 5632; cultivated lands, *Palmer* 388 in 1898. Parras, *Palmer* 1352 in 1880.

**NUEVO LEÓN:** Monterrey, edge of field, *Hitchcock* 5526½.

**ZACATECAS:** Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7498, 7511. Plateado, *Rose* 2703.

**AGUASCALIENTES:** Aguascalientes, weed, edge of field, *Hitchcock* 7447; sterile rocky hill, *Hitchcock* 7478.

**SAN LUIS POTOSÍ:** San Luis Potosí, *Schaffner* 165; edge of field, *Hitchcock* 5674, 5710.

**JALISCO:** Guadalajara, on roof of hotel, *Hitchcock* 7264; prairie, by cornfield near San Pedro, *Hitchcock* 7266; *Palmer* 474 in 1886. Río Blanco, *Palmer* 501, 501a in 1886. Zapotlán, railway right of way, *Hitchcock* 7116. San Nicolás, prairie, *Hitchcock* 7191. Chapala, *Rose* 3472, *Rose & Painter* 7624. Colotlán, *Rose* 2812.

**GUANAJUATO:** Irapuato, dry shrubby hill, *Hitchcock* 7429. Acámbaro, along railway, *Hitchcock* 6924, 6954.

**QUERÉTARO:** Querétaro, rocky hill, *Hitchcock* 5832.

**8. *Aristida lanuginosa* Scribn. sp. nov.**

Perennial; culms cespitose, about 1 meter high, erect, lanate-pubescent except in the region of the nodes, scabrous below the panicle; leaves mostly basal, the sheaths lanate-pubescent except above the nodes, this portion glabrous; ligule a ciliate-lanate ring; blades 10 to 25 cm. long, 1 to 2 mm. wide, ending in a long fine point, sparsely lanate-pubescent, the older culm blades flat and curled, the upper culm blades and those of the innovations involute; panicle 10 to 25 cm. long, narrow, the branches appressed, the lowermost as much as 10 cm. long, naked below, a short branchlet at base; spikelets on short appressed pedicels; glumes 1-nerved, acuminate or short-awned, sparsely lanate, scabrous on the keels, the lower 6 to 7 mm. long, the upper about 1 mm. longer; lemma smooth below except the short-pilose callus, scabrous above, tapering into a scabrous, slightly twisted neck, the entire length, including the neck, about 11 mm.; awns subequal, somewhat spreading, the central one about 15 mm. long, the lateral about 12 mm. long.

Type in the U. S. National Herbarium, no. 691230, collected on "Hills near Guadalajara, Jalisco," Mexico, October 28, 1889, by C. G. Pringle (no. 2375). This species was distributed under this name but it had not been described.

**RANGE:** Pacific slope of Mexico.

**HERBARIUM SPECIMENS:**

**DURANGO:** Durango, rocky hill, *Hitchcock* 7649.



## HERBARIUM SPECIMENS—Continued.

JALISCO: Guadalajara, hills, *Pringle* 2375; gravelly plains, *Pringle* 11734; dry open ground, along rim of Barranca de Oblatos, *Hitchcock* 7324.

MICHOACÁN: Morelia, *Arsène* in 1909.

9. *Aristida palmeri* Vasey, Bull. Torrey Club 10: 42. 1883.

Type locality, "Southern Arizona," the type specimen collected by Palmer in 1869.

RANGE: Southwestern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Catalina Mountains, *Orcutt* 1, 2.

CHIHUAHUA: Miñaca, mesa, *Hitchcock* 7754. Chihuahua, hills and plains, *Pringle* 388.

ZACATECAS: Hacienda de Cedros, foothills, *Lloyd* 195.

PUEBLA: Esperanza, rocky hill, *Hitchcock* 6492.

10. *Aristida longiramea* Presl, Rel. Haenk. 1: 224. 1830.

Type locality, "Mexico," the particular locality not given.

RANGE: Throughout Mexico.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Chihuahua, rocky hills, *Pringle* 387.

TEPIC: Tepic, small bunches on grassy plains and banks of arroyos, *Palmer* 1916 in 1892.

JALISCO: Guadalajara, *Palmer* in 1885; plains of Guadalajara, *Pringle* 1810; prairie near San Pedro, *Hitchcock* 7274, 7275. San Nicolás, prairie, *Hitchcock* 7227; sterile hill, *Hitchcock* 7233. Río Blanco, *Palmer* 768a, 476, 516, 517, 520 in 1886. Zapotlán, railway right of way, *Hitchcock* 7115.

MICHOACÁN: Morelia, *Arsène* in 1909.

FEDERAL DISTRICT: *Pringle* 6493, 6544, 6549.

PUEBLA: Tochimilco, *Nelson* in 1893. Puebla, *Nicolas* in 1908 and 1909.

MORELOS: Cuernavaca, *Holway* 3020.

OAXACA: Las Sedas, *Smith* 918.

11. *Aristida spadicea* H. B. K. Nov. Gen. & Sp. 1: 123. 1816.

Type locality, "juxta Guanaxuato et Mina de Belgrade," the first locality cited, the species also found on the banks of the Orinoco and in inundated borders of Guayaquil River.

RANGE: Plateau of Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 5 in 1885. Miñaca, rocky hill, *Hitchcock* 7752, 7764. Sánchez, gravel flat, bottom of ravine, *Hitchcock* 7709, 7717.

JALISCO: Jalisco, *Palmer* in 1886.

FEDERAL DISTRICT: Pedregal, lava, *Hitchcock* 5935, 5960.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6139.

12. *Aristida arizonica* Vasey, Bull. Torrey Club 13: 27. 1886.

Type locality, "Arizona."

RANGE: Southwestern United States and northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Santa Eulalia Mountains, *Pringle* 389.

NUEVO LEÓN: Monterey, rocky hill among shrubs, *Hitchcock* 5520.

13. *Aristida divaricata* Humb. & Bonpl. in Willd. Enum. Pl. 99. 1809.

Type locality, "Mexico."

RANGE: Southwestern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Catalina Mountains, *Orcutt* 1, 2.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

CHIHUAHUA: Miñaca, mesa, *Hitchcock* 7754. Chihuahua, hills and plains, *Pringle* 388.

ZACATECAS: Hacienda de Cedros, foothills, *Lloyd* 195.

PUEBLA: Esperanza, rocky hill, *Hitchcock* 6492.

SONORA: Along railway 10 miles south of Nogales, *Hitchcock* 3635.

CHIHUAHUA: Near White Water, *Mearns* 355. Sánchez, along railway, *Hitchcock* 7730. Chihuahua, rocky hill, *Hitchcock* 7785. Miñaca, along run, *Hitchcock* 7736; dry run, *Hitchcock* 7760, 7761.

DURANGO: Durango, in shade on lower slopes of hills, *Palmer* 873 in 1896; dry ground, *Hitchcock* 7577; rocky hill, Iron Mountain, *Hitchcock* 7642.

ZACATECAS: Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7517, 7518.

AGUASCALIENTES: Aguascalientes, weed, edge of field, *Hitchcock* 7446, 7448.

SAN LUIS POTOSÍ: San Luis Potosí edge of field, *Hitchcock* 5687; *Schaffner* 175.

JALISCO: Río Blanco, *Palmer* 284 and 768 in 1886. Zapotlán, railway right of way, *Hitchcock* 7112, 7119, 7145. Guadalajara, prairie, *Hitchcock* 7280, 7299, 7308.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6717.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6894. Popo Park, open ground, *Hitchcock* 6028. Federal District, *Pringle* 6408, 9576; along railway, *Hitchcock* 5907; *Orcutt* 3676.

PUEBLA: San Marcos, railway embankment, *Hitchcock* 6515, 6536. Chalchicomula, along dike in field, *Hitchcock* 6289; rocky hill, *Hitchcock* 6303. Esperanza, rocky hill, *Hitchcock* 6481.

VERACRUZ: Jalapa, along railway, *Hitchcock* 6545.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6155; along road, *Hitchcock* 6106.

14. *Aristida liebmanni* Fourn. Mex. Pl. 2: 78. 1886.

Type locality, "Mirador," the type specimen collected by Liebmann (no. 662).

RANGE: Known only from the type collection.

15. *Aristida berlandieri* (Trin. & Rupr.).

*Aristida purpurea*  $\beta$  *berlandieri* Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3<sup>1</sup>: 107. 1842.

Type locality, "Texas pr. Bejar," the type specimen collected by Berlandier (no. 1777).

RANGE: Southwestern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Saltillo, rocky hill, *Hitchcock* 5618; low places, *Palmer* 265 in 1898; mountains, *Palmer* 1351 in 1880; among rocks on hillside, *Palmer* 392 in 1898.

NUEVO LEÓN: Monterey, along railway, *Hitchcock* 5566.

SAN LUIS POTOSÍ: Cárdenas, prairie, *Hitchcock* 5724. Minas de San Rafael, *Purpus* 5010.

PUEBLA: Tehuacán, dry tufa bluffs, *Pringle* 8556; cactus hill, *Hitchcock* 6084.

16. *Aristida micrantha* (Vasey) Nash in Small, Fl. Southeast. U. S. 117. 1903.

*Aristida purpurea* var. *micrantha* Vasey, Contr. U. S. Nat. Herb. 3: 47. 1892.

Type locality, "Western Texas."

RANGE: Southwestern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Saltillo, rocky hill, *Hitchcock* 5616. Mountains west of Saltillo, *Palmer* 1351 in 1880.

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5526, 5567.

TAMAULIPAS: Victoria, *Palmer* 429 in 1907.

SAN LUIS POTOSÍ: Micos, rocky bluffs, *Pringle* 3790.

YUCATÁN: Mérida, *Schott* 601.



17. *Aristida wrightii* Nash in Small, Fl. Southeast. U. S. 116. 1903.

Type locality, "Dallas, Texas," the type specimen collected by Reverchon (no. 1061).

RANGE: Southwestern United States to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

PUEBLA: Esperanza, rocky hill, *Hitchcock* 6487. Tehuacán, limestone hills, *Pringle* 8592.

18. *Aristida fendleriana* Steud. Syn. Pl. Glum. 1: 420. 1854.

Type locality, New Mexico, the type specimen collected by Fendler (no. 973).

RANGE: Southwestern United States to central Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Topo, *Orcutt* 1146.

COAHUILA: Díaz, dry mesas, *Pringle* 9037.

19. *Aristida longiseta* Steud. Syn. Pl. Glum. 1: 420. 1854.

Type locality, New Mexico, the type specimen collected by Fendler (no. 978).

RANGE: Southwestern United States and northern Mexico.

HERBARIUM SPECIMEN FROM MEXICO:

CHIHUAHUA: Plains near Chihuahua, *Pringle* 473.

## 60. *STIPA* L. Sp. Pl. 78. 1753.

### KEY TO THE SPECIES.

- Awn strongly plumose, bent once..... 1. *S. speciosa*.
- Awn not plumose, often scabrous or pubescent.
- Lemma or base of awn long-pilose.
- Fruit 3 mm. long, pilose at summit..... 15. *S. ichu*.
- Fruit 7 mm. long, pilose all over.
- Awn with 1 bend; plant about 0.5 meter high.... 2. *S. parishii*.
- Awn with 2 bends; plant about 1 meter high..... 3. *S. coronata*.
- Lemma more or less pubescent, but not long-pilose.
- Fruit 3 mm. long; awn very slender, flexuous..... 16. *S. tenuisissima*.
- Fruit more than 3 mm. long.
- Glumes about 3 cm. long, subequal; lemma about 1.5 cm. long..... 4. *S. melanosperma*.
- Glumes shorter.
- Panicle open, the branches long and spreading.
- Fruit short-pilose below, glabrous and punctulate-roughened above, with a constricted neck ciliate at summit.
- Fruit 1 cm. long..... 5. *S. leucotricha*.
- Fruit 5 mm. long..... 6. *S. trochlearis*.
- Fruit short-pilose all over.
- Mature fruit dark-colored, turgid, 8 mm. long, the hairs brown.... 8. *S. pringlei*.
- Mature fruit light-colored, slender, 5 to 6 mm. long, the hairs white. 7. *S. eminens*.
- Panicle narrow, the branches ascending or appressed.
- Mature fruit dark-colored, turgid, the hairs brown.
- Fruit 4 mm. long..... 9. *S. mucronata*.
- Fruit 6 mm. long..... 10. *S. virescens*.



Mature fruit light-colored, slender, the hairs white.

Ligule about 5 mm. long, membranaceous..... 12. *S. editorum*.

Ligule short.

Ligule a dense ring of hairs..... 11. *S. clandestina*.

Ligule membranaceous or sometimes hairy at margins.

Fruit 5 mm. long; culms glabrous..... 14. *S. multinodis*.

Fruit 7 mm. long; culms puberulent below the nodes..... 13. *S. vaseyi*.

1. *Stipa speciosa* Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 5<sup>1</sup>: 45. 1842.

Type locality, "Chile," the type specimen collected by Cuming.

RANGE: California to Colorado and southward in arid regions of the Pacific slope to Chile.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Los Angeles Bay, *Palmer* 505 in 1887. Japa, *Orcutt* 1140.

2. *Stipa parishii* Vasey, Bot. Gaz. 7: 33. 1882.

Type locality, "San Bernardino Mountains," California, the type specimen collected by S. M. Parish.

RANGE: Western Nevada, southern and Lower California.

HERBARIUM SPECIMEN FROM MEXICO:

LOWER CALIFORNIA: Sierras Cantillas, *Orcutt* 1151.

3. *Stipa coronata* Thurb. in S. Wats. Bot. Calif. 2: 287. 1880.

Type locality, southwestern California, two specimens being cited: "Hills near Julian City, San Diego County (*Bolander*); near San Bernardino, *Parry & Lemmon*, n. 422 (1876)."

RANGE: Coast Ranges, California and Lower California.

HERBARIUM SPECIMEN FROM MEXICO:

LOWER CALIFORNIA: Nachognero Valley, *Schoenfeldt* 3441.

4. *Stipa melanosperma* Presl, Rel. Haenk. 1: 226. 1830.

Type locality, unknown to Presl.

RANGE: Except the type only known from the following.

HERBARIUM SPECIMEN:

PUEBLA: Esperanza, rocky hill, *Hitchcock* 6488.

5. *Stipa leucotricha* Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 5<sup>1</sup>: 54. 1842.

Type locality, "Texas," the type specimen collected by Hooker.

RANGE: Southwestern United States to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Rio Grande Valley near Díaz, *Pringle* 8292.

ZACATECAS: Zacatecas, in gulches of dry sterile hill, *Hitchcock* 7495, 7522.

SAN LUIS POTOSÍ: Cárdenas, prairie, *Hitchcock* 5714.

MÉXICO: Santa Fé, *Bourgeau* 672. Barranca of Río Aqueducto, *Rose & Painter* 8636. Federal District, bank along ditch, *Hitchcock* 5918.

6. *Stipa trochlearis* Nees & Meyen, Nov. Act. Acad. Caes. Leop. Carol. 19: Suppl. 1: 151. 1843.

Type locality, Peru, two localities cited: "Ad Arequipam urbem Peruviae in campis siccis pedum 12000 altitud., et ad lacum Titicacam."

RANGE: Highlands of Mexico to western South America.



## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Parral, *Schumann* 1726.

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5545.

ZACATECAS: Zacatecas, rocky soil, *Purpus* in 1904; in gulch in dry sterile hills, *Hitchcock* 7503.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6744; sandy river bed, *Hitchcock* 6762, 6763.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6892. Federal District, open grassy ground, *Hitchcock* 5931; *Pringle* 6583.

PUEBLA: Esperanza, dry open ground, *Hitchcock* 6463.

7. *Stipa eminens* Cav. Icon. Pl. 5: 42. pl. 467. f. 1. 1799.

*Stipa flexuosa* Vasey, Bull. Torrey Club 15: 49. 1888.

Type locality, "prope oppidum mexicanum Chalma."

RANGE: Highlands of Mexico.

The species described in Flora of California<sup>1</sup> under the name *S. eminens* differs in having a very short ligule and somewhat longer awns, and may be a distinct species. This form is found also in Lower California on Cedros Island (*Palmer* 661 in 1889).

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Guadalupe Ranch, *Orcutt* in 1886.

SONORA: Fronteras, *Hartman* 20.

CHIHUAHUA: Santa Eulalia Mountains, *Pringle* 384, *Wilkinson* in 1885.

DURANGO: Durango, rocky hill, Iron Mountain, *Hitchcock* 7624; in the mountains, *Palmer* 523 in 1896.

ZACATECAS: Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7524; hills, *Pringle* 2043. Hacienda de Cedros, foothills, *Lloyd* 187, 212.

SAN LUIS POTOSÍ: San Luis Potosí, in clump of bushes, *Hitchcock* 5671; *Parry & Palmer* 929 in 1878.

JALISCO: Zacoalco, *Bourgeau* 669.

QUERÉTARO: San Juan del Río, *Rose, Painter & Rose* 9581.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6700, 6742. Sierra de la Mesa, *Rose, Painter & Rose* 9099. Tula, limestone hills, *Rose, Painter & Rose* 8362.

MÉXICO: Río Hondo, hillsides, *Pringle* 6228. Federal District, *Pringle* 9564. Near Chapultepec Castle, *Hitchcock* 7837.

PUEBLA: Esperanza, barren hills, *Pittier* 443; rocky hill, *Hitchcock* 6486. Tehuacán, dry limestone hills, *Pringle* 6766; dry cactus soil among agaves, *Hitchcock* 6079. Chalchicomula, rocky hill, among shrubs, *Hitchcock* 6274.

8. *Stipa pringlei* (Beal) Scribn. in Vasey, Contr. U. S. Nat. Herb. 3: 54. 1892.

*Oryzopsis pringlei* Beal, Bot. Gaz. 15: 112. 1890.

Type locality, "Chihuahua, Mexico," the type specimen collected by *Pringle* in 1887 (no. 1410).

RANGE: Mountains of Arizona and Chihuahua.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sierra Madre, dry ledges, *Pringle* 1410. Sánchez, rocky pine woods, *Hitchcock* 7677, 7681.

9. *Stipa mucronata* H. B. K. Nov. Gen. & Sp. 1: 125. 1816.

Type locality, "in montanis regni Mexicani, prope Actopan et vicum Magdalenae."

RANGE: Known only from the State of Mexico.

## HERBARIUM SPECIMENS:

MÉXICO: Nevado de Toluca, *Rose & Painter* 6434. Sierra de las Cruces, mountain meadows, *Pringle* 4299, 11756. Popo Park, open pine woods, *Hitchcock* 6014. Popocatepetl, *Rose & Hay* 6035; open ground along trail, *Hitchcock* 5989.

<sup>1</sup> *Hitchcock* in *Jepson, Fl. Calif.* 1: 105. 1912.



**10. *Stipa virescens* H. B. K. Nov. Gen. & Sp. 1: 126. 1816.**

Type locality, "in subfrigidis regni Mexicani, prope St. Rosa et Cuesta de Belgrado," a second locality "La Buffa, juxta Guanaxuato," also cited.

RANGE: Highlands of central and southern Mexico.

## HERBARIUM SPECIMENS:

ZACATECAS: Plateado, *Rose* 2750.

JALISCO: Zapotlán, hills, *Hitchcock* 7169. Volcano de Colima, *Jones* 479. Nevado de Colima, in timber, road from Zapotlán, *Hitchcock* 7151.

HIDALGO: Between Pachuca and Real del Monte, in oak woods, *Rose, Painter & Rose* 8700.

MICHOACÁN: Morelia, Cerro Azul, *Arsène* 2699.

MÉXICO: Popo Park, woods, *Hitchcock* 5965, 5973, 6019. Federal District, pine woods, *Pringle* 6588, 9574; lava field, *Hitchcock* 5947; *Orcutt* 3731.

PUEBLA: Mount Orizaba, open woods, *Hitchcock* 6266; *Rose & Hay* 5671. Chinantla, *Liebmann* 649.

VERACRUZ: Cabrestros, *Liebmann* 650.

MORELOS: Sierra de Ajusco, *Pringle* 6236.

OAXACA: Sierra de San Felipe, *Nelson* 1107; *Smith* 926; *Pringle* 4759. Oaxaca, *Nelson* 1373. Cumbre de Estepec, *Liebmann* 648.

**11. *Stipa clandestina* Hack. Repert. Nov. Sp. Fedde 8: 516. 1910.**

Type locality, "Mexico, Prope Michoacan," the type collected by Brother Arsène (no. 3441); a second specimen "Coahuila leg. E. Palmer, no. 3 (Apr. 1898)" also cited.

RANGE: Known only from the type locality.

## HERBARIUM SPECIMENS:

COAHUILA: Saltillo, dry ground, *Hitchcock* 5579; rich bottom lands, *Palmer* 3 in 1898; *Nil* in 1909; *Nicolas* in 1909.

**12. *Stipa editorum* Fourn. Mex. Pl. 2: 75. 1886.**

Type locality, "In valle edita inter La Noria del Viego et La Miquiguana," the type specimen collected by Karwinsky (no. 1009c).

RANGE: Highlands of southern Mexico.

## HERBARIUM SPECIMENS:

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6716.

PUEBLA: Esperanza, dry open ground, *Hitchcock* 6469; rocky hill, *Hitchcock* 6494; along railway, *Hitchcock* 6500. San Marcos, railway embankment, *Hitchcock* 6520. Oriental, *Orcutt* 3947.

**13. *Stipa vaseyi* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 46. 1898.**

*Stipa viridula* var. *robusta* Vasey, Contr. U. S. Nat. Herb. 1: 56. 1890.

Type locality, "Chenete Mountains (Presidio county)," Texas, the type specimen collected by Nealley (no. 714).

RANGE: Colorado to Texas and south to Lower California and Coahuila.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Todos Santos Island, *Anthony* 202. Northern Lower California, *Orcutt* in 1886. Guadalupe Ranch, *Orcutt* in 1886. San Telmo, *Orcutt* in 1886.

COAHUILA: Lerios, *Palmer* 1249 in 1880; Saltillo, *Palmer* 317 in 1902.

**14. *Stipa multinodis* Scribn. in Beal, Grasses N. Amer. 2: 222. 1896.**

Type locality, "Mexico," the type specimen collected by *Pringle* (no. 385) in Santa Eulalia Mountains.

RANGE: Highlands of northern Mexico.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Santa Eulalia Mountains, *Pringle* 385. Santa Eulalia Plains, *Wilkinson* 349.

COAHUILA: Saltillo, rocky hill, *Hitchcock* 5617.



**15. *Stipa ichu* (Ruiz & Pav.) Kunth, Rév. Gram. 1: 60. 1829.***Jarava ichu* Ruiz & Pav. Fl. Peruv. Chil. Prodr. 2. pl. 1. 1794.*Stipa liebmanni* Fourn. Mex. Pl. 2: 76. 1886. ("Cerro Leon pr. Perote," Veracruz, (Liebmann 667), a depauperate specimen differing from *S. ichu* in being about 15 cm. high and in having slender involute blades).

Type locality, mountains of Peru.

RANGE: Highlands of Mexico, south in the mountains to Patagonia.

## HERBARIUM SPECIMENS FROM MEXICO:

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 174; *Parry & Palmer* 967 in 1878.MÉXICO: Sierra de las Cruces, cool ledges, *Pringle* 4281. Ixtaccihuatl, *Purpus* 323; dry mountain slopes, *Purpus* 1610. Popocatepetl, open woods, *Purpus* 1609. Montezuma, *Bourgeau* 1156. Cima, *Orcutt* 3788.PUEBLA: Esperanza, along railway, *Hitchcock* 6498, 6502; dry open ground, *Hitchcock* 6467; barren hills, *Pittier* 423. Chalchicomula, ravine, *Hitchcock* 6275; hills, *Pringle* 9566. San Marcos, railway embankment, *Hitchcock* 6521. Manzanilla, *Nicolas* in 1909.VERACRUZ: Cerro León, *Liebmann* 667.OAXACA: Chinantla, *Liebmann* 669. Sierra de Clavellinas, open slopes, *Pringle* 4998.**16. *Stipa tenuisissima* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 2<sup>1</sup>: 36. 1836.**

Type locality, Chile, the type specimen collected at Mendoza by Gillies, and sent to Trinius by Hooker in 1835.

RANGE: Southwestern United States to Chile.

## HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Saltillo, *Nil* in 1909; *Nicolas* in 1909; *Palmer* 341½ and 455 in 1904. Carneros Pass, *Pringle* 3274.PUEBLA: San Marcos, railway embankment, *Hitchcock* 6518, 6519, 6540. Esperanza, dry open ground, *Hitchcock* 6464; along railway, *Hitchcock* 6499.**61. ORYZOPSIS Michx. Fl. Bor. Amer. 1: 51. pl. 9. 1803.**

## KEY TO THE SPECIES.

Glumes pubescent; fruit globular-fusiform, densely clothed with  
a soft white brush-like pubescence ..... 1. *O. hymenoides*.

Glumes glabrous.

Fruit dark, brown-pubescent, acute at both ends..... 2. *O. fimbriata*.Fruit pale, white-pubescent, the apex blunt, the base sub-  
acute..... 3. *O. florulenta*.**1. *Oryzopsis hymenoides* (Roem. & Schult.) Ricker; Piper, Contr. U. S. Nat. Herb. 11: 109. 1906.***Stipa hymenoides* Roem. & Schult. Syst. Veg. 2: 339. 1817.*Eriocoma cuspidata* Nutt. Gen. Pl. 1: 40. 1818.

Type locality, "On the banks of the Missouri," the type specimen collected by Bradbury.

RANGE: Manitoba to Washington, south to northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Cantillas Mountains, *Orcutt* 1147.CHIHUAHUA: Sand hills near Paso del Norte, *Pringle* 1053.**2. *Oryzopsis fimbriata* (H. B. K.) Hemsl. Biol. Centr. Amer. Bot. 3: 538. 1885.***Stipa fimbriata* H. B. K. Nov. Gen. & Sp. 1: 126. 1816.

Type locality, "in alta planitie Mexicana inter Burras et Guanaxuato," a second locality, "Mina de Villalpando," also cited.

RANGE: Mountain regions of Mexico.



## HERBARIUM SPECIMENS:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandegge* in 1899.

CHIHUAHUA: Miñaca, base of rocky butte, *Hitchcock* 7741.

DURANGO: Otinapa, *Palmer* 339 in 1906.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6749, 6751. Woodlands near Trinidad Iron Works, *Pringle* 13249; Sierra de Pachuca, *Rose, Painter & Rose* 8744.

MÉXICO: Ixtaccihuatl, *Purpus* 1637.

TLAXCALA: Contadero, *Pringle* 8595.

PUEBLA: San Luis Tultitlanapa, *Purpus* 3589. Esperanza, rocky hill, *Hitchcock* 6532.

OAXACA: Oaxaca, *Nelson* 1373a.

3. *Oryzopsis florulenta* Pilg. Bot. Jahrb. Engler. 27: 26. 1899.

Type locality, "Columbia: \* \* \* in monte Alto de Pesares supra Popayan," the type specimen collected by Lehmann (no. 6980).

RANGE: Mountains, southern Mexico to Colombia.

## HERBARIUM SPECIMENS FROM MEXICO:

TLAXCALA: Contadero Station, hills, *Pringle* 8596.

PUEBLA: Esperanza, rocky hill, *Hitchcock* 6493; *Seaton* 319.

62. *PIPTOCHAETIUM* Presl, Rel. Haenk. 1: 222. pl. 37. f. 1—7. 1830.1. *Piptochaetium brevicalyx* (Fourn.) Ricker.

*Stipa brevicalyx* Fourn. Mex. Pl. 2: 150. 1886.

Type locality, "Circa San Luis de Potosi," the type specimen collected by Parry and Palmer (no. 959).

RANGE: Highlands of central and southern Mexico.

## HERBARIUM SPECIMENS:

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 959.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6733. Real del Monte, in oak woods, *Rose, Painter & Rose* 8744.

63. *MUHLENBERGIA* Schreb. in Gmel. Syst. Nat. 2: 87, 171. 1791.

## KEY TO THE SPECIES.

Plants annual.

Awn of lemma short, not longer than the body of the lemma (sometimes slightly longer in *M. ligulata*).

Glumes ciliate; panicle open, the branches spreading..... 1. *M. texana*.

Glumes not ciliate.

Second glume strongly 3-toothed, the teeth about equal..... 8. *M. pusilla*.

Second glume not distinctly 3-toothed.

Lemma entire; panicle green..... 3. *M. ligulata*.

Lemma bifid, awned from between the short teeth; panicle tawny.

Panicle open..... 2. *M. flavida*.

Panicle narrow, the branches short and appressed..... 2a. *M. flavida strictior*.

Awn of lemma more than twice as long as the body of the lemma.

Glumes or some of them awned, the awn as long as the body of the glume or longer.

One glume of some of the upper spikelets of each branch long-awned..... 4. *M. diversiglumis*.



One glume and often both of all spikelets awned.

Panicle open, the primary branches spreading; lemma ciliate.....

5. *M. ciliata*.

Panicle narrow, the branches appressed.

Glumes narrow, firm, the first usually bifid.....

14. *M. schaffneri*.

Glumes broad at base, membranous, entire.....

6. *M. tenella*.

Glumes not awned, often acute or acuminate.

Second glume broad, 3-toothed; awn flexuous...

7. *M. peruviana*.

Second glume entire; awn straight.

Lemma 2-lobed; glumes villous.....

15. *M. biloba*.

Lemma entire; glumes not villous.

Second glume 2 to 3 mm. long.

Leaves clustered at the base of the nearly simple culms, the sheaths inflated.....

9. *M. pulcherrima*.

Leaves not clustered nor with inflated sheaths; culms freely branching.....

10. *M. quitensis*.

Second glume not over 1 mm. long.

Glumes acute or mucronate; body of lemma 1.5 mm. long.....

11. *M. nebulosa*.

Glumes obtuse; body of lemma 2 to 3 mm. long.

Pedicels capillary, flexuous or recurved.....

12. *M. implicata*.

Pedicels short, relatively stout, often reflexed but not curved or flexuous.....

13. *M. microsperma*.

Plants perennial.

Plants producing creeping rhizomes; blades short; stems usually low, often decumbent; awn usually short.

Callus hairs conspicuous; glumes awned, nearly as long as the short-awned or long-awned lemma; blades flat.....

17. *M. lemmoni*.

Callus hairs inconspicuous.

Main culms tall, woody, conspicuously larger than the numerous slender branches.....

21. *M. dumosa*.

Main culms slender.

Glumes very short, the second 0.5 mm. or less long, the first nearly obsolete; culms long and straggling.....

16. *M. schreberi*.

Glumes longer, subequal.

Panicle narrow or reduced, the main branches short, appressed.

Ligule 2 to 3 mm. long; blades flat, thin; spikelets scarcely 2 mm. long.....

20. *M. repens*.

Ligule short; blades more or less involute, firm; spikelets about 3 mm. long.....

18. *M. squarrosa*.

Panicle open, at least the main branches spreading or ascending, slender.



- Spikelets 3 mm. long; spikelets clustered toward the ends of the stiffly ascending branches; blades flat, about 2 mm. wide .. 22. *M. plumbea*.
- Spikelets about 1.5 mm. long, not clustered; blades filiform, about 0.5 mm. wide, often involute..... 19. *M. breviseta*.
- Plants not producing creeping rhizomes.
- Glumes less than 1 mm. long.
- Panicle spreading..... 23. *M. seatonii*.
- Panicle narrow.
- Ligule very short; blades flat or becoming involute.... 24. *M. spiciformis*.
- Ligule 2 to 3 mm. long; blades closely involute..... 25. *M. parviglumis*.
- Glumes more than 1 mm. long.
- Culms lax, clambering, decumbent and rooting at base; blades flat, short, as much as 8 mm. wide..... 26. *M. setarioides*.
- Culms not lax, erect at base, but sometimes becoming decumbent.
- Plants widely spreading, much branched, wiry; panicles diffuse..... 27. *M. porteri*.
- Plants not widely much branched.
- Culms ascending, more or less decumbent below, rather slender; blades short.
- Awn of lemma long and slender; spikelets short-pediceled on the main panicle branches..... 28. *M. brevifolia*.
- Awn of lemma shorter than its body; spikelets slender-pediceled in an open panicle..... 29. *M. arizonica*.
- Culms erect or nearly so.
- Second glume 3-toothed.
- Teeth awned; lemma hirsute..... 30. *M. gracilis*.
- Teeth unawned; lemma slightly pubescent. .... 31. *M. quadridentata*.
- Second glume entire or sometimes erose or 2-toothed.
- Awn of lemma not longer than the body.
- Panicle close, spike-like; glumes awned..... 33. *M. wrightii*.
- Panicle narrow or open, not spike-like.
- Blades mostly less than 10 cm. long; panicle open, the slender branches ascending..... 32. *M. arenicola*.
- Blades more than 10 cm. long; panicle narrow, the branches appressed.
- Glumes 3 to 4 mm. long; panicle lead-colored; branches rather stout..... 34. *M. firma*.
- Glumes 1 to 2 mm. long; branches capillary.
- Panicle branches naked below; panicle purple..... 35. *M. laxiflora*.
- Panicle branches with short spikelet-bearing branchlets at base..... 56. *M. acuminata*.
- Awn of lemma longer than the body.
- Awns yellow, flexuous; plants 20 to 30 cm. high.
- Glumes subequal..... 36. *M. scabra*.
- Glumes unequal, the first shorter..... 37. *M. flaviseta*.



Awns not yellow nor strongly flexuous.

Blades short, mostly not over 10 cm. long;  
plants comparatively low.

Lemma 2-lobed, the lobes 0.5 mm. long;  
panicle rather open..... 38. *M. argentea*.

Lemma entire or minutely toothed.

Panicle open, the short branches  
spreading; glumes abruptly awned 39. *M. alamosae*.

Panicle narrow, the branches ap-  
pressed.

Lemma 4 to 5 mm. long; glumes less  
than half as long, broad, thin;  
blades involute, mostly basal... 40. *M. setifolia*.

Lemma 2 to 3 mm. long; glumes  
more than half as long; blades  
scattered.

Lemma conspicuously hairy;  
glumes as long as lemma,  
awned ..... 41. *M. polycaulis*.

Lemma slightly hairy or glabrous;  
glumes shorter, acute or  
awned.

Ligule 2 mm. long; lemma hairy  
at base, 2 mm. long; glumes  
acute..... 43. *M. monticola*.

Ligule inconspicuous, 1 mm.  
long; lemma glabrous, 3 mm.  
long; glumes often awned.. 42. *M. pauciflora*.

Blades elongated; plants usually tall and  
stout.

Panicle large, diffuse; branches and  
pedicels capillary.

Panicle about 50 cm. long; spikelets  
about 3 mm. long; plants often 2  
meters high..... 44. *M. elata*.

Panicle mostly less than 30 cm. long;  
spikelets about 4 mm. long;  
plants not so tall..... 45. *M. affinis*.

Panicle not diffuse.

Glumes shorter than the lemma.

Glumes obtuse, erose or obscurely  
toothed; lemma villous..... 54. *M. enervis*.

Glumes more or less acute.

Blades flat, strongly nerved above;  
ligule 1 to 2 mm. long..... 55. *M. palmeri*.

Blades involute.

Blades smooth; panicle green.. 56. *M. acuminata*.

Blades scabrous, at least on the  
attenuated point.

Lemma 3 mm. long, scarcely  
nerved; panicle green or  
tawny..... 57. *M. elongata*.

Lemma 5 mm. long, strongly  
nerved; panicle purple.. 58. *M. berlandieri*.



Glumes or at least one of them as long  
as the body of the lemma.

Glumes villous..... 46. *M. speciosa*.

Glumes not villous.

Spikelets about 2 mm. long.

Ligule less than 5 mm. long;  
throat villous; blades 4 to

5 mm. wide..... 49. *M. grandis*.

Ligule conspicuous, 1 cm. long  
or more; throat not villous;

blades 1 to 2 mm. wide.... 47. *M. distichophylla*.

Spikelets more than 2 mm. long.

Glumes unequal, the first half as  
long as the second; lemma

villous..... 50. *M. virescens*.

Glumes about equal.

Blades flat; glumes obtuse or  
acutish..... 48. *M. vaseyana*.

Blades involute, or very nar-  
row.

Blades smooth on the lower

surface..... 51. *M. articulata*.

Blades very scabrous.

Basal sheaths not strap-

shaped..... 52. *M. longiglumis*.

Basal sheaths strap-

shaped..... 53. *M. straminea*.

**1. *Muhlenbergia texana* Buckl. Proc. Acad. Phila. 1862: 91. 1863.**

*Sporobolus annuus* Vasey, Bull. Torrey Club 14: 9. 1887.

*Muhlenbergia buckleyana* Scribn. Contr. U. S. Nat. Herb. 1: 56. 1890.

Type locality, "Northern Texas."

RANGE: Texas and Arizona to Durango and Lower California.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de San Francisquito, *Brandegge* in 1899.

CHIHUAHUA: Chihuahua, wet ledges, rocky hills, *Pringle* 399; on gravel bars of  
streams, rocky hills, *Pringle* 400. Miñaca, in bed of rocky run, *Hitchcock*  
7768. Sánchez, open ground in pine woods, *Hitchcock* 7664½. Noragachie,  
*Palmer* 3d in 1885.

DURANGO: Sandías Station, barranca, *Pringle* 13629. Dos Cajetes, among thickets,  
*Palmer* 797 in 1896.

**2. *Muhlenbergia flavida* Vasey, Contr. U. S. Nat. Herb. 1: 282. 1893.**

Type locality, "Rio Blanco," the type specimen collected by *Palmer* (no. 645).

RANGE: Highlands from northern to central Mexico.

HERBARIUM SPECIMENS:

CHIHUAHUA: Sierra Madre, wet places, *Pringle* 3034. Guayanopa Canyon, *Jones*  
7316.

JALISCO: Río Blanco, *Palmer* 645 in 1886. Guadalajara, ravines, *Pringle* 11749.

HIDALGO: Canales Station, bogs, *Pringle* 8951.

**2a. *Muhlenbergia flavida strictior* Scribn.; Beal, Grasses N. Amer. 2: 263. 1896.**

*Muhlenbergia strictior* Scribn.; Beal, Grasses N. Amer. 2: 263. 1896.

Type locality, "Mexico," the type specimen collected in the Sierra Madre by  
*Pringle* (no. 1418).



RANGE: Highlands of northern Mexico.

HERBARIUM SPECIMENS:

CHIHUAHUA: Sánchez, rocky dry bed of stream, *Hitchcock* 7673. Miñaca, along bed of rocky run, *Hitchcock* 7765. Sierra Madre, wet ledges by streams, *Pringle* 1418; *Jones* 7315.

DURANGO: Sandías Station, barranca, *Pringle* 13630.

3. *Muhlenbergia ligulata* (Fourn.) Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 19. 1901.

*Chaboissaea ligulata* Fourn. Mex. Pl. 2: 112. 1886.

Type locality, "San Luis de Potosi," the type specimen collected by Virlet.

RANGE: Central Mexico.

HERBARIUM SPECIMENS:

DURANGO: Durango, moist soil, in large prostrate masses, *Palmer* 731 in 1896.

Sienga, moist soil, *Palmer* 948 in 1896.

4. *Muhlenbergia diversiglumis* Trin. Mém. Acad. St. Pétersb. VI. 4<sup>1</sup>: 298. 1841.

Type locality, "Mexico, Porto Pedro," the type specimen collected by Karwinsky.

RANGE: Highlands of southern Mexico to Costa Rica.

HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, moist ledges of barranca, *Pringle* 1739, 2661, 11235. Zapotlán, rocky hill, *Hitchcock* 7254.

MICHOACÁN: Curú Station, rock fields, *Pringle* 13246.

MORELOS: Sierra de Tepostlán, thin soil, *Pringle* 8364.

5. *Muhlenbergia ciliata* (H. B. K.) Kunth, Rév. Gram. 1: 63. 1829.<sup>1</sup>

*Podosaemum ciliatum* H. B. K. Nov. Gen. & Sp. 1: 128. 1816.

Type locality, "in radicibus, montis ignivomi Mexicani, Jorullo."

RANGE: Highlands throughout Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandege* 18a. Sierra de San Francisco, *Brandege* 16.

CHIHUAHUA: Sierra Madre, dry shaded ledges, Arroyo Aucho, *Pringle* 1435.

DURANGO: Durango, under overhanging rock at hilltop, *Palmer* 719 in 1896.

JALISCO: Guadalajara, moist ravines, *Pringle* 11745; narrow shady ditch near San Pedro, *Hitchcock* 7295. Zapotlán, on brick wall, *Hitchcock* 7256. San Nicolás, sterile clay hill, *Hitchcock* 7203. Chapala, *Rose* 3479. Bolaños, *Rose* in 1897.

MICHOACÁN: Uruapán, open stony place, *Hitchcock* 6966½. Curú Station, rock fields, *Pringle* 13245. Morelia, *Arsène* in 1909.

MÉXICO: San Nicolás, *Bourgeau* 1034. Federal District, lava fields, *Pringle* 9584; *Orcutt* 4247.

VERACRUZ: Zacuapan, wet soil, *Purpus* 2899. Orizaba, *Botteri* 707; *Mohr* in 1857; *Ross* 1174.

MORELOS: Cuernavaca, large tufts, side of rocky cliff, *Hitchcock* 6860; barranca, *Pringle* 11229; *Rose & Painter* 6931.

OAXACA: Cuicatlán, valley, *Nelson* 1869. Oaxaca, *Rose* 3688.

6. *Muhlenbergia tenella* (H. B. K.) Trin. Gram. Unifl. 192. 1824.

*Podosaemum tenellum* H. B. K. Nov. Gen. & Sp. 1: 128. 1816.

Type locality, "in scopulosis frigidis andium Mexicanorum, inter Rio Frio et Baranca Honda \* \* \* (Prov. Xalapensi.)."

RANGE: Highlands, Chihuahua to Costa Rica.

<sup>1</sup> This and several other combinations under *Muhlenbergia* are commonly credited to Trin. Gram. Unifl. 193 and 194, 1824, but Trinius there merely lists a number of species, some doubtfully, as belonging to *Muhlenbergia* without formally transferring them to that genus.



## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Batopilas, *Palmer* in 1885.

SINALOA: Lodiago, in moist shady place in rocky canyon, *Palmer* 1667 in 1891.  
Copradía, *Brandeggee* in 1904.

JALISCO: Guadalajara, moist ledges of barranca, *Pringle* 1745, 1775; moist banks, *Pringle* 11748; *Palmer* 404 and 481 in 1886. Zapotlán, rocky hill, *Hitchcock* 7257.

COLIMA: Colima, *Palmer* 1271 in 1891; *Orcutt* 4571.

MICHOACÁN: Baqueta, *Langlassé* 494.

VERACRUZ: San Francisco, *Smith* 1506. Córdoba, *Fink* in 1893; *Bourgeau* 1665.

MORELOS: Yautepec, calcareous banks, *Pringle* 11232.

7. *Muhlenbergia peruviana* (Beauv.) Steud. Nom. Bot. ed. 2. 1: 41. 1840.

*Clomena peruviana* Beauv. Ess. Agrost. 28. 1812.

*Muhlenbergia clomena* Kunth, Rév. Gram. 1: 64. 1829.

Type locality, Peru, the specimen sent to Beauvois by Thibaut.

RANGE: Highlands, northern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sierra Madre, porphyry ledges, *Pringle* 1411. Mapula Mountains, thin soil of summits, *Pringle* 824. Sánchez, open ground in pine woods, *Hitchcock* 7663; along railway, *Hitchcock* 7722.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 932 in 1878; *Schaffner* 180, 181.

JALISCO: Nevado de Colima, open ground, *Hitchcock* 7156.

MÉXICO: Flor de María, prairies, *Pringle* 3316. Nevado de Toluca, *Rose & Painter* 7925. Salto de Agua, *Purpus* 1620. Federal District, lava fields, *Pringle* 9065. Cuantepec, *Bourgeau* 1155.

8. *Muhlenbergia pusilla* Steud. Syn. Pl. Glum. 1: 177. 1854.

Type locality, "Tolucca," the type specimen collected by Berlandier (no. 1141).

RANGE: High mountains in the State of Mexico.

## HERBARIUM SPECIMENS:

MÉXICO: Nevado de Toluca, *Rose & Painter* 6435. Ixtaccihuatl, rocks above timber line, *Purpus* 1621, 3780.

This species may possibly be a depauperate form of *M. peruviana*.

9. *Muhlenbergia pulcherrima* Scribn.; Beal, Grasses N. Amer. 2: 240. 1896.

Type locality, "Mexico," the type specimen collected in the Sierra Madre by *Pringle* (no. 1416).

RANGE: Mountains of northern and central Mexico.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Sierra Madre, dry ledges of porphyry, *Pringle* 1416.

MORELOS: Tres Marías Mountains, *Pringle* 11743.

10. *Muhlenbergia quitensis* (H. B. K.).

*Calamagrostis quitensis* H. B. K. Nov. Gen. & Sp. 1: 133. 1816.

*Muhlenbergia calamagrostidea* Kunth, Rév. Gram. 1: 63. 1829.

Type locality, "regni Mexicani prope Mescala, Sochipala et Valle Zopilote," no reference to Quito being made, the specific name evidently given inadvertently, hence Kunth's change of the specific name to "*calamagrostidea*."

RANGE: Highlands of Mexico.

## HERBARIUM SPECIMENS:

SONORA: Cochuto, *Hartman* 60, 77.

CHIHUAHUA: Santa Eulalia, *Palmer* 133 in 1908; plains, *Wilkinson* in 1885; hills, *Wilkinson* 344. Chihuahua, under shrubs, hills and plains, *Pringle* 397; rocky hills, *Pringle* 428; along dry run, *Hitchcock* 7779.



## HERBARIUM SPECIMENS—Continued.

DURANGO: Durango, crevices of rocks on hillsides, *Palmer* 881 in 1896; in bunches in crevices near top of hill, *Palmer* 882 in 1896; mountains, *Palmer* 528 in 1896; crevices of rocks on hillside, *Palmer* 725 in 1896; dry ground, *Hitchcock* 7572.

COAHUILA: Saltillo, sandy ground near river, *Hitchcock* 5624; *Palmer* 393 in 1898. Sierra de Parras, *Purpus* 5007.

ZACATECAS: Hacienda de Cedros, plains, *Lloyd* 204 in 1908. Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7509; along dry river bed, *Hitchcock* 7533. Plateado, *Rose* 2786.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7459, *Rose & Painter* 7730.

SAN LUIS POTOSÍ: Cárdenas, railway cut, *Hitchcock* 5726. San Luis Potosí, *Parry & Palmer* 930 in 1878. Sierra de Guascama, *Purpus* 5429.

JALISCO: Guadalajara, *Palmer* 457 and 482 in 1886; on roof of hotel, *Hitchcock* 7260.

QUERÉTARO: Querétaro, rocky hill among cacti, *Hitchcock* 5848; *Rose & Rose* 11188. Between San Juan del Río and Cadereyta, *Rose, Painter & Rose* 9680.

HIDALGO: Ixmiquilpan, *Rose, Painter & Rose* 8992. El Salto, railroad banks, *Pringle* 11744. Pachuca, rocky slopes, *Purpus* 1627; *Orcutt* 3915.

MICHOACÁN: Morelia, *Arsène* in 1909.

MÉXICO: Valley of Mexico, *Bourgeau* 218. Federal District, *Pringle* 9563; on top of stone wall, *Hitchcock* 5871; *Ross* 53; *Rose, Painter & Rose* 8494. Without locality, *Schumann* 1745.

PUEBLA: Tehuacán, old field, *Hitchcock* 6038; among cacti, *Hitchcock* 6078. San Luis Tultitlanapa, *Purpus* 3590.

OAXACA: Oaxaca, cleft in rocky cliff, *Hitchcock* 6159.

**11. *Muhlenbergia nebulosa* Scribn.; Beal, Grasses N. Amer. 2: 247. 1896.**

Type locality, "Mexico, wet places, hills near Guadalajara," the type specimen collected by *Pringle* (no. 2366).

RANGE: Pacific slope of Mexico.

HERBARIUM SPECIMENS.

TEPIC: Tepic, moist spot in canyon, *Palmer* 1933 in 1892.

JALISCO: Guadalajara, wet places, hills, *Pringle* 2366. Río Blanco, wet soil, *Pringle* 11753.

COLIMA: Alzada, *Orcutt* 4629.

**12. *Muhlenbergia implicata* (H. B. K.) Kunth, Rév. Gram. 1: 63. 1829.**

*Podosaemum implicatum* H. B. K. Nov. Gen. & Sp. 1: 127. 1816.

Type locality, "in humidis, uliginosis Andium Mexicanorum prope lacum Cuiseo et Puerto de Andaracuas."

RANGE: Northern Mexico in the mountains to South America.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Potrero Mountains, rocky banks of streams, *Pringle* 818.

DURANGO: Durango, rocky hill, Iron Mountain, *Hitchcock* 7639; mountain side, *Palmer* 769 in 1896; rich moist shaded ground among agaves, *Palmer* 718 in 1896; shady side of arroyo, *Palmer* 830 in 1896.

JALISCO: Zapotlán, hills, *Hitchcock* 7179, 7251. Guadalajara, prairie near San Pedro, *Hitchcock* 7289.

MICHOACÁN: Morelia, *Arsène* in 1909.

MÉXICO: Toluca, *Holway* 3138. Salto de Agua, *Purpus* 1622. Federal District, lava fields, *Pringle* 9057; *Orcutt* 4307; *Rose & Painter* 6820; *Bourgeau* 1557.

PUEBLA: Cholula, *Deam* in 1899. Puebla, *Nicolas* in 1910.

VERACRUZ: Consoquitla, *Liebmann* 640. Orizaba, *Botteri* 679; *Müller* 2102.

OAXACA: Monte Albán, thin soil of limestone ledges, *Pringle* 4950.



**13. *Muhlenbergia microsperma* (DC.) Kunth, Rév. Gram. 1: 64. 1829.***Trichochloa microsperma* DC. Cat. Hort. Monsp. 151. 1813.

Type locality, "Mexico."

RANGE: Southwestern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Island of San Pedro Mártir, *Palmer* 416 in 1887. San Telmo, *Orcutt* 1435. Cedros Island, *Palmer* 663 in 1889. San Quentin Bay, *Palmer* 687 in 1889. Santa Agueda, *Palmer* 217 in 1890. Cape St. Lucas, *Xantus* 116. San José del Cabo, *Purpus* 524. Comondú, *Brandeggee* in 1889. Sierra de San Francisquito, *Brandeggee* in 1899. La Chuparosa, *Brandeggee* in 1899. La Paz, *Palmer* 729 in 1890. Misión, *Orcutt* in 1899. Calmallí, *Orcutt* in 1899. Guadalupe Island, *Palmer* 656 and 670 in 1889. Gulf of California, *Palmer* 416 and 510 in 1887.

SONORA: Guaymas, *Palmer* 272 and 510 in 1887. Magdalena, *Rose, Standley & Russell* 15092. Hermosillo, rocky hillside among cacti, *Chase* 5504; *Rose, Standley & Russell* 12506. Alamos, *Palmer* 691 in 1890.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 158 in 1885.

DURANGO: Tlahualilo, barren hills, *Pittier* 432.

SAN LUIS POTOSÍ: San Luis Potosí, edge of field, *Hitchcock* 5700.

GUANAJUATO: Irapuato, dry shrubby hill, *Hitchcock* 7426.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6701; *Orcutt* 3915 in part.

PUEBLA: San Marcos, railway embankment, *Hitchcock* 6513. Esperanza, rocky hill, *Hitchcock* 6470. Chalchicomula, dry ground, *Hitchcock* 6304; *Nelson* 251. Mount Orizaba, *Seaton* 246.

OAXACA: Monte Albán, *Smith* 938. Cuicatlán, *Nelson* 1703a. Ocotlán, *Liebmann* 639.

**14. *Muhlenbergia schaffneri* Fourn. Mex. Pl. 2: 85. 1886.**

Type locality, "Prope Tacubaya," Federal District, the type specimen collected by Schaffner.

RANGE: New Mexico and Arizona south in the mountains to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Santa Eulalia Mountains, ledges, *Pringle* 404; *Pringle* in 1888. Sánchez, open ground in pine woods, *Hitchcock* 7664.

DURANGO: Durango, rocky hill, Iron Mountain, *Hitchcock* 7644, 7645. Sandías Station, barranca, *Pringle* 13634.

ZACATECAS: Río Hondo, ledges, *Pringle* 3894.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7468.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 178.

HIDALGO: El Salto, sandy soil, *Pringle* 11231.

FEDERAL DISTRICT: *Orcutt* 4311.

**15. *Muhlenbergia biloba* nom. nov.**

*Bealia mexicana* Scribn. in Hack. True Grasses 103, 104. f. 45a. 1890, not *Muhlenbergia mexicana* (L.) Trin. 1824.

Type locality, "Thin soil of dry porphyry mountains. Mexico (Chihuahua)," as given in Beal's Grasses of North America,<sup>1</sup> where the species is more fully described, the type specimen collected by Pringle (no. 819).

RANGE: Pacific slope of northern Mexico.

## HERBARIUM SPECIMENS:

LOWER CALIFORNIA: Santa Margarita Island, *Brandeggee* in 1889.

CHIHUAHUA: Chihuahua, dry porphyry mountains, *Pringle* 819.

DURANGO: Barranca below Sandías Station, *Pringle* 10147.

<sup>1</sup>2: 268. 1896.



**16. *Muhlenbergia schreberi* Gmel. Syst. Nat. 2: 171. 1791.***Muhlenbergia diffusa* Willd. Sp. Pl. 1: 320. 1805.

Type locality not given.

RANGE: Northern United States to southeastern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Jalapa, bank of railway cut through jungle, *Hitchcock* 6648; along railway near Coatepec, *Hitchcock* 6663. Orizaba, *Botteri*.**17. *Muhlenbergia lemmoni* Scribn. in Coulter, Contr. U. S. Nat. Herb. 1: 56. 1890.**

Type locality, "Arizona," Huachuca Mountains, according to data on the type specimen collected by Lemmon (no. 2918).

RANGE: Southwestern United States and south in the highlands to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, cleft of boulder in rocky ravine, *Hitchcock* 7685. Chihuahua, cool wet ledges, rocky hills, *Pringle* 394, 395.DURANGO: Durango, rocky hill, Iron Mountain, *Hitchcock* 7635, 7635½. Sandías Station, barranca, *Pringle* 13632.SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 144, 189. Villar, limestone ledges, *Pringle* 4539. Bagre, *Purpus* 5426.GUANAJUATO: Acámbaro, under cliffs, *Pringle* 13247.FEDERAL DISTRICT: Wet ledges of ravines, *Pringle* 8263.**18. *Muhlenbergia squarrosa* (Trin.) Rydb. Bull. Torrey Club 36: 531. 1909.***Vilfa squarrosa* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3<sup>1</sup>: 100. 1840.

Type locality, "America septentr[ionalis] in Ins. Menzies," the specimen sent to Trinius by Hooker.

RANGE: Montana to Washington and south in the mountains to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandeggee* in 1899.SONORA: San Pedro River, Mexican boundary line, *Mearns* 1128.CHIHUAHUA: Sánchez, bottom of rocky ravine, *Hitchcock* 7710. Chihuahua, by streams, *Pringle* 418.DURANGO: Durango, along dike of pond, *Hitchcock* 7653; in stiff, alkaline soil, *Palmer* 738 and 739 in 1896.COAHUILA: Jaral, *Schumann* 1750. Saltillo, open dry ground, *Hitchcock* 5613; in close tangled mat, dry ground near ditch, *Hitchcock* 5652; dry field, *Ross* 1493.ZACATECAS: Zacatecas, gulch, dry sterile hill, *Hitchcock* 7497.SAN LUIS POTOSÍ: San Luis Potosí, edge of field, *Hitchcock* 5688, 5701; *Schaffner* 163.HIDALGO: Pachuca, rocky hill, *Hitchcock* 6736; sandy river bed, *Hitchcock* 6756.MÉXICO: Toluca, along roadside bank, the runners hanging down the bank, *Hitchcock* 6919. Federal District, open ground along railway, *Hitchcock* 5928.PUEBLA: Chalchicomula, dry ground along track, *Hitchcock* 6268. San Marcos, along railway embankment, *Hitchcock* 6507. Esperanza, along railway, *Hitchcock* 6501.**19. *Muhlenbergia breviseta* Griseb.; Fourn. Mex. Pl. 2: 83. 1886.**Type locality, "Orizaba," the following specimens from this place cited: Müller 1453, 2003, 2093, *Schaffner* 111 in herb. Franqueville, 157 in "pl. ed. Hohen."

RANGE: Highlands of southern Mexico.

HERBARIUM SPECIMENS:

VERACRUZ: Orizaba, *Müller* 1453, *Botteri*.JALISCO: Zapotlán, pine woods, *Hitchcock* 7249.MICHOACÁN: Pátzcuaro, dry cool soil, hills, *Pringle* 3944. Uruápan, dry fields, *Pringle* 13900; sandy fields, *Pringle* 10370.



**20. Muhlenbergia repens** (Presl) Hitchc. in Jepson, Fl. Calif. 1: 111. 1912.*Sporobolus repens* Presl, Rel. Haenk. 1: 241. 1830.

Type locality, "Mexico."

RANGE: Texas to California and south to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 17 in 1885. Sánchez, along railway, *Hitchcock* 7723.MÉXICO: Flor de María, shallow ponds of prairies, *Pringle* 3317.PUEBLA: Puebla, *Nicolas* in 1910.VERACRUZ: Orizaba, *Bourgeau* 3285.**21. Muhlenbergia dumosa** Scribn. in Vasey, Contr. U. S. Nat. Herb. 3: 71. 1892.Type locality, "Arizona," the type specimen collected "by streams of the Santa Catalina Mts. June 3, 1882," by *Pringle*.

RANGE: Arizona and southward along the Pacific slope to Jalisco.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Sierra de los Alamos, *Palmer* 406 in 1890; *Rose, Standley & Russell* 12802. Teraverachi, *Hartman* 264.DURANGO: San Ramón, *Palmer* 51 in 1906.JALISCO: Sierra de San Esteban near Guadalajara, cool wet ledges, *Pringle* 2355, 11230.**22. Muhlenbergia plumbea** (Trin.).*Vilfa plumbea* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3<sup>1</sup>: 98. 1840.*Sporobolus plumbeus* Hemsl. Biol. Centr. Amer. Bot. 3: 546. 1885.

Type locality, "Mexico, Min. del monte," the type specimen received from Schlechtendal.

RANGE: Highlands of southern Mexico.

HERBARIUM SPECIMENS:

MÉXICO: Toluca, along ditch, *Hitchcock* 6911. Federal District, alkaline meadows, *Pringle* 6617, 9581; open pasture land, *Hitchcock* 5899.PUEBLA: San Marcos, railway embankment, *Hitchcock* 6525. Esperanza, rocky hill, *Hitchcock* 6533. Puebla, *Nicolas* in 1910. Chalchicomula, along railway, *Hitchcock* 6308.**23. Muhlenbergia seatonii** Scribn. in Seaton, Proc. Amer. Acad. 28: 122. 1893.

Type locality, "Hills near Esperanza," the type specimen collected by Seaton (no. 320).

RANGE: Known only from the type collection.

**24. Muhlenbergia spiciformis** Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4<sup>1</sup>: 288. 1841.

Type locality, "Mexico," the type specimen collected by Karwinsky.

RANGE: Highlands of central and southern Mexico.

HERBARIUM SPECIMENS:

SAN LUIS POTOSÍ: Tamasopo Canyon, limestone ledges, *Pringle* 3992.MICHOACÁN: Maravatío, *Arsène* in 1908.VERACRUZ: Orizaba, *Bourgeau* 3327, *Müller* 2100. Alta Luz, *Purpus* 5070.OAXACA: Oaxaca, limestone cliffs, *Pringle* 6025.**25. Muhlenbergia parviglumis** Vasey, Contr. U. S. Nat. Herb. 3: 71. 1892.

Type locality, "Texas," the type specimen collected by Nealley.

RANGE: Texas to San Luis Potosí.

HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Saltillo, very dry hillsides, *Palmer* 417 in 1898.SAN LUIS POTOSÍ: Minas de San Rafael, *Purpus* 5011.



**26. *Muhlenbergia setarioides* Fourn. Mex. Pl. 2: 84. 1886.**

Type locality, "Orizaba" and "Sierra de Cristobal pr. Eugenio" cited, with several collections from the first named.

RANGE: Veracruz to Guatemala.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Under spray of waterfall in the barranca of Texolo, near Jalapa, *Pringle* 8096. Orizaba, *Bourgeau* 3362, *Botteri* 698, *Mohr* 8.

**27. *Muhlenbergia porteri* Scribn.; Beal, Grasses N. Amer. 2: 259. 1896.**

*Muhlenbergia texana* Thurb. in Port. & Coult. Syn. Fl. Colo. 145. 1874, not Buckl. 1863.

Type locality, "Texas."

RANGE: Southwestern United States and along the Pacific slope to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Imeris to Santa Ana, *Griffiths* 6853.

CHIHUAHUA: Chihuahua, hills and plains, *Pringle* 478. Juárez, dry mesas, *Pringle* 11233. Between Casas Grandes and Sabinal, *Nelson* 6349.

DURANGO: Torreón, rocky hill, *Hitchcock* 7548.

**28. *Muhlenbergia brevifolia* Scribn.; Beal, Grasses N. Amer. 2: 254. 1896.**

Type locality, "Mexico (Jalisco)," the type specimen collected by *Pringle* (no. 4736).

RANGE: Known only from the type locality.

## HERBARIUM SPECIMENS:

JALISCO: Guadalajara, wet ledges, *Pringle* 4736, 5367, 9562.

**29. *Muhlenbergia arizonica* Scribn. Bull. Torrey Club 15: 8. pl. 76. f. a. 1888.**

Type locality, "Mesas near the Mexican boundary," Arizona, the type specimen collected by *Pringle* in 1884.

RANGE: Arizona along the Pacific slope to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Altar to Sasabe, *Griffiths* 6917.

CHIHUAHUA: Chihuahua, thin, dry soil, rocky hills, *Pringle* 402; dry bed of river, *Hitchcock* 7784.

SINALOA: Copradía, *Brandege* in 1904. Lodiago, on river bottoms often inundated, *Palmer* 1663 in 1891.

DURANGO: Durango, hillsides and plains, *Palmer* 536 and 713 in 1896; rocky hill, *Hitchcock* 7590.

**30. *Muhlenbergia gracilis* (H. B. K.) Kunth, Rév. Gram. 1: 64. 1829.**

*Podosaemum gracile* H. B. K. Nov. Gen. & Sp. 1: 131. 1816.

Type locality, "in aridis exustis montis Mexicani, Volcan de Jorullo."

RANGE: Wyoming to California and southward in the mountains to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Santa Eulalia Mountains, high summits, *Pringle* 392, 393. Sierra Madre near Colonia García, pine woods, *Townsend & Barber* 332. Southwestern Chihuahua, *Palmer* 10a in 1885. Miñaca, rocky hill, *Hitchcock* 7769. Sánchez, rocky pine woods, *Hitchcock* 7668.

JALISCO: Guadalajara, *Palmer* in 1886.

MICHOACÁN: Morelia, *Arsène* in 1909.

MÉXICO: Cima, *Rose & Painter* 7211. Federal District, Serrania de Ajusco, *Pringle* 11750.

OAXACA: Sierra de San Felipe, *Smith* 927, 928. High ridge west of San Miguel Huantla, *Nelson* 1910.



**31. *Muhlenbergia quadridentata* (H. B. K.) Kunth, Rév. Gram. 1: 64. 1829.***Podosaemum quadridentatum* H. B. K. Nov. Gen. & Sp. 1:130. 1816.

Type locality, "in siccis apricis regni Mexicani prope Toluca, Puente de Tepare et Playas de Jorullo."

RANGE: High mountains of southern Mexico.

## HERBARIUM SPECIMENS:

JALISCO: Nevado de Colima, steep hillside, *Hitchcock* 7159, 7161.MÉXICO: Popocatepetl, steep hillside in open woods, *Hitchcock* 5981; *Rose & Hay* 6261.**32. *Muhlenbergia arenicola* Buckl. Proc. Acad. Phila. 1862: 91. 1863.**

Type locality, "Arid places in Western Texas."

RANGE: Texas to Arizona and Chihuahua.

## HERBARIUM SPECIMEN FROM MEXICO:

CHIHUAHUA: Chihuahua, plains, *Pringle* 479.**33. *Muhlenbergia wrightii* Vasey in Coulter, Man. Rocky Mount. 409. 1885.**

Type locality, New Mexico, the type specimen collected by Wright.

RANGE: Colorado and southward in the mountains to southern Chihuahua.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, along railway, *Hitchcock* 7693½. Base of Sierra Madre, wet places, pine plains, *Pringle* 1419; meadow, *Townsend & Barber* 331.**34. *Muhlenbergia firma* Beal, Grasses N. Amer. 2: 243. 1896.**Type locality, "Mexico (Oaxaca)," the type specimen collected by *Pringle* (no. 4914).

RANGE: Highlands of southern Mexico.

## HERBARIUM SPECIMENS:

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6750, 6753.MÉXICO: Federal District, lava beds, *Pringle* 6675, 13631.PUEBLA: Esperanza, rocky hill, *Hitchcock* 6479, 6531. Chalchicomula, large bunches, rocky hill, *Hitchcock* 6276, 6297, 6298. San Marcos, railway embankment, *Hitchcock* 6529.OAXACA: Sierra de San Felipe, *Smith* 230; summit ledges, *Pringle* 4914.**35. *Muhlenbergia laxiflora* Scribn. Zoe 4:389. 1894.**Type locality, "La Chuparosa," Lower California, the type specimen collected by *Brandeggee* in 1893 (no. 74).

RANGE: Pacific slope of Mexico.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Sierra Madre, cool slopes, *Pringle* 1412. Mount Mohinora, *Nelson* 4902, 4903. Sánchez, rocky pine woods, *Hitchcock* 9221.DURANGO: Southern Durango, *Rose* 2356.OAXACA: Sierra de San Felipe, *Conzatti & González* 438.**36. *Muhlenbergia scabra* S. Wats. Proc. Amer. Acad. 18: 174. 1883.**Type locality, "San Luis Potosí," the type specimen collected by *Schaffner* (no. 1067).

RANGE: Known only from the type locality.

## HERBARIUM SPECIMEN:

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 179 in 1877.**37. *Muhlenbergia flaviseta* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 8: 11. pl. 7. 1897.**Type locality, "Mexico," the type specimen collected on sloping sides of an arroyo, in the region of pines and oaks, 8,500 feet alt., Dos Cajetes, Durango, in 1896 by *Palmer* (no. 834).

RANGE: Known only from the type collection.



**38. *Muhlenbergia argentea* Vasey, Bull. Torrey Club 13: 232. 1886.**

Type locality, "S. W. Chihuahua," the type specimen collected in 1885 by Palmer (no. 160).

RANGE: Known only from the type collection.

**39. *Muhlenbergia alamosae* Vasey, Bot. Gaz. 16: 146. 1891.**

Type locality, "Alamosa in Sonora," the type specimen collected in 1890 by Palmer (no. 407).

RANGE: Highlands from northwestern to central Mexico.

## HERBARIUM SPECIMENS:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandege* 79 in 1892.

SONORA: Sierra de los Alamos, *Palmer* 407 in 1890; moist ravine, *Rose, Standley & Russell* 13109.

CHIHUAHUA: Sánchez, on large boulder, *Hitchcock* 7701.

DURANGO: San Ramón, *Palmer* 67 in 1906.

MORELOS: Sierra de Tepoxtlán, mossy cliffs, *Pringle* 6994.

**40. *Muhlenbergia setifolia* Vasey, Bot. Gaz. 7: 92. 1882.**

Type locality, "Guadalupe Mountains of Western Texas," the type collected by Havard.

RANGE: Texas and the highlands of northern Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

COAHUILA: Saltillo, dry slopes, *Palmer* 415 in 1898.

**41. *Muhlenbergia polycaulis* Scribn. Bull. Torrey Club 38: 327. 1911.**

Type locality, "Dry shaded ledges, Sierra Madre Mts., State of Chihuahua," the type specimen collected by *Pringle* (no. 1414).

RANGE: Arizona and south in the highlands to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, cool wet ledges, rocky hills, *Pringle* 394. Sierra Madre, dry shaded ledges, *Pringle* 1414.

DURANGO: Durango, in crevices of rocks, *Palmer* 529 and 724 in 1896. Barranca below Sandías Station, *Pringle* 13633.

GUANAJUATO: Acámbaro, under cliffs, *Pringle* 13248.

**42. *Muhlenbergia pauciflora* Buckl. Proc. Acad. Phila. 1862: 91. 1863.**

Type locality, "Hillsides, Western Texas."

RANGE: Texas to Arizona and Chihuahua.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Cañon de San Diego, *Hartman* 793; mountain near San Diego, *Hartman* 754.

**43. *Muhlenbergia monticola* Buckl. Proc. Acad. Phila. 1862: 91. 1863.**

Type locality, "Northwestern Texas."

RANGE: Texas to Arizona and southward in the mountains to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: San José Mountains, *Mearns* 998. Guadalupe Canyon, *Merton* 2036.

CHIHUAHUA: Santa Eulalia Mountains, *Wilkinson* in 1885; dry limestone ledges, *Pringle* 396; Chihuahua, cleft of rock on side of gorge, *Hitchcock* 7787.

COAHUILA: Saltillo, rocky hill, *Hitchcock* 5619.

HIDALGO: Tula, limestone hills, *Rose, Painter & Rose* 8363.

**44. *Muhlenbergia elata* Vasey, Contr. U. S. Nat. Herb. 1: 282. 1893.**

Type locality, "Guadalajara," the type specimen collected in 1886 by Palmer (no. 770).

RANGE: Highlands of southern Mexico.



## HERBARIUM SPECIMENS:

JALISCO: San Nicolás, sterile clay hill, *Hitchcock* 7216. Guadalajara, *Palmer* 770 in 1886, *Palmer* in 1885; banks of ravines, *Pringle* 2351, 11747; prairie, *Hitchcock* 7306; dry open ground, side of Barranca de Oblatos, *Hitchcock* 7332, 7333. Río Blanco, *Palmer* 523 and 523a in 1886.

COLIMA: Alzada, *Orcutt* 4649.

MICHOACÁN: Morelia, *Arsène* 2465.

VERACRUZ: Mirador, *Liebmann* 675. Consoquitla, *Liebmann* 674.

MORELOS: Cuernavaca, rocky prairie, *Hitchcock* 6878.

45. *Muhlenbergia affinis* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4<sup>1</sup>: 301. 1841.

Type locality, "Toluco," the type specimen collected by Berlandier.

RANGE: Texas to Arizona and south in the highlands to Oaxaca.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 13 in 1885. Sánchez, rocky pine woods, near dry bed of stream, *Hitchcock* 7674. Miñaca, mesa, *Hitchcock* 7747. Santa Eulalia Mountains, *Pringle* 401.

DURANGO: Durango, rough, stony hills and arroyos, *Palmer* 859 and 860 in 1896, dry ground, *Hitchcock* 7595, 7608.

COAHUILA: San Lorenzo Canyon, *Palmer* 400 in 1904.

ZACATECAS: Zacatecas, gulch in dry sterile hills, *Hitchcock* 7504, 7508, 7514.

AGUASCALIENTES: Aguascalientes, sterile, rocky hill, *Hitchcock* 7475.

JALISCO: Orozco, railway bank by pond, *Hitchcock* 7371. San Nicolás, sterile hill, *Hitchcock* 7235. Guadalajara, prairie, *Hitchcock* 7301; *Palmer* 522 in 1886. Between Mezquitic and Monte Escobedo, *Rose* 2614. Bolaños, *Rose* 2984.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6728.

MICHOACÁN: Uruápan, prairie, *Hitchcock* 6972, 6981. Morelia, *Arsène* 2595.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6887. Federal District, near Chapultepec Castle, *Hitchcock* 7838; lava rock, *Hitchcock* 5940; *Pringle* 9557; *Bourgeau* 753; *Orcutt* 4305.

PUEBLA: San Marcos, large bunches, sandy soil, *Hitchcock* 6541. Esperanza, rocky hill, *Hitchcock* 6471. San Luis Tultitlanapa, *Purpus* 2900.

VERACRUZ: Orizaba, *Botteri* 679.

OAXACA: Las Sedas, *Smith* 952. Oaxaca, large bunches, rocky hill, *Hitchcock* 6149. Mountain ridge, west side of valley of Cuicatlán, *Nelson* 1905. Near Reyes, *Nelson* 1806.

46. *Muhlenbergia speciosa* Vasey, Bull. Torrey Club 13: 231. 1886.

Type locality, southwestern Chihuahua, the type specimen collected in 1885 by *Palmer* (no. 30).

RANGE: Highlands from Chihuahua to Puebla.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 30 in 1885.

SINALOA: Culiacán, *Brandege* in 1904.

TEPIC: Tepic, growing in compact bunches, along banks of arroyos, *Palmer* 1919 in 1892.

PUEBLA: Zapotitlán, dry hills, *Ross* 1308.

47. *Muhlenbergia distichophylla* (Presl) Kunth, Enum. Pl. 1: 202. 1833.

*Podosaemum distichophyllum* Presl, Rel. Haenk. 1: 231. 1830.

Type locality, "Mexico."

RANGE: New Mexico and south on the Pacific slope of Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Batopilas, *Palmer* in 1885.

JALISCO: Guadalajara, rocky hills, *Pringle* 2350.

MICHOACÁN: Sierra Madre, *Langlassé* 607. Cerro Mamegal, *Langlassé* 674.



**48. *Muhlenbergia vaseyana* Scribn. Rep. Mo. Bot. Gard. 10: 52. 1899.**

Type locality, "Rocky cañon, Arizona," the type specimen collected by Rothrock, Wheeler Exped. (no. 282).

RANGE: Texas to Arizona and south in the highlands to Oaxaca.

**HERBARIUM SPECIMENS FROM MEXICO:**

LOWER CALIFORNIA: El Taste, *Brandegge* in 1893. San Francisquito Mountains, *Brandegge* in 1890 and 1899. Sierra de la Laguna, *Brandegge* in 1899.

SONORA: San José Mountains, *Mearns* 962. Sierra de los Alamos, *Palmer* 409 in 1890.

CHIHUAHUA: Sánchez, rocky pine woods, *Hitchcock* 7669; rocky hill, *Hitchcock* 7714. Santa Eulalia Hills, *Wilkinson* in 1885. Miñaca, rocky hill, *Hitchcock* 7742.

DURANGO: Durango, Iron Mountain, *Palmer* 542 in 1896; rocky hill, *Hitchcock* 7621. Otinapa, *Palmer* 553 in 1906.

COAHUILA: Jaral, *Schumann* 1753 in 1885.

MICHOACÁN: Morelia, *Arsène* 2674.

MÉXICO: Ixtaccihuatl, rocks, barrancas, *Purpus* 1611. Salto de Agua, rocky hillsides, *Purpus* 1629. Federal District, Pedregal, *Rose, Painter & Rose* 8255, 9456.

PUEBLA: Cerro de Soluche, *Purpus* 4081.

OAXACA: Oaxaca, *Smith* 916. Reyes, *Nelson* 1780. Sierra de San Felipe, *Smith* 927; summit ledges, *Pringle* 5577. Dolores, *Liebmann* 737.

**49. *Muhlenbergia grandis* Vasey, Contr. U. S. Nat. Herb. 1: 283. 1893.**

Type locality, "Rio Blanco," the type specimen collected in 1886 by Palmer (no. 515).

RANGE: Known only from Jalisco.

**HERBARIUM SPECIMENS:**

JALISCO: Guadalajara, cool slopes of barranca, *Pringle* 1760, 2362. Río Blanco, *Palmer* 515, 515a, and 682 in 1886; slopes of barranca, *Pringle* 11751.

**50. *Muhlenbergia virescens* (H. B. K.) Kunth, Rév. Gram. 1: 64. 1829.**

*Podosaemum virescens* H. B. K. Nov. Gen. & Sp. 1: 132. 1816.

Type locality, "locis asperis, excelsis regni Mexicani prope Santa Rosa de la Sierra et Puerto de Varientos."

RANGE: New Mexico and Arizona to central Mexico.

**HERBARIUM SPECIMENS FROM MEXICO:**

ZACATECAS: Sierra Madre, *Rose* 3527.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 920 and 928 in 1878.

**51. *Muhlenbergia articulata* Scribn. Proc. Acad. Phila. 1891: 298. f. 1. 1892.**

Type locality, "Calcareous banks, Cardenas, State of San Luis Potosí," the type specimen collected by Pringle (no. 3477).

RANGE: Known only from type locality.

**HERBARIUM SPECIMEN:**

SAN LUIS POTOSÍ: Cárdenas, dry calcareous hills, *Pringle* 3913.

**52. *Muhlenbergia longiglumis* Vasey, Contr. U. S. Nat. Herb. 1: 283. 1893.**

Type locality, "Guadalajara," the type specimen collected by Palmer (no. 766).

RANGE: Pacific slope of southwestern Mexico.

**HERBARIUM SPECIMENS:**

JALISCO: Guadalajara, rocky hills, *Pringle* 11752; hillsides under pines, *Pringle* 2365; *Palmer* 766 in 1886.

MICHOACÁN: Morelia, *Arsène* in 1909.



**53. *Muhlenbergia straminea* sp. nov.**

Tufted stramineous perennial, the base more or less rhizomatous; culms erect, flattened, smooth below, scabrous above, 50 to 80 cm. high; sheaths scabrous, the lower with age becoming papery, flat and ribbon-like; ligule membranaceous, 3 to 12 mm. long; blades scabrous, 2 mm. wide, flat or usually involute, about as long as the culms, tapering into a long, slender, flexuous point; panicles narrow, tawny, 10 to 20 cm. long, the branches appressed, rather densely flowered, the lower 4 to 7 cm. long, the stout branchlets and short pedicels scabrous; glumes nearly equal, scabrous, tawny, rather papery, narrow, acuminate, 4 to 5 mm. long, the first 1-nerved, the second 3-nerved; lemma scarcely so long as the glumes, 3-nerved, villous with white hairs below, scabrous above, tapering into a slender flexuous awn 5 to 15 mm. long, the callus broad and short; palea a little shorter than the lemma, villous below and scabrous above.

Type in the U. S. National Herbarium, no. 691888, collected in the western Sierra Madre at Tecorichu, Chihuahua, in pine and oak woods, 2,200 meters altitude, April 10, 1906, by R. Endlich (no. 1210).

This species is distinguished by the stramineous appearance of the glumes and foliage and by the flat, ribbon-like lower sheaths, which withdraw from the culms and become spirally twisted or curled like shavings. The long, papery glumes indicate an affinity with *Triniochloa*, but it is distinguished from that genus by the terminal awn of the lemma. It appears to be most nearly allied to *M. longiglumis*.

The only additional specimens examined were collected in the same region at Tierra Colorada by Endlich (no. 1226, 1210a). One of these specimens (no. 1210a) has deformed spikelets. The specimens in the United States National Herbarium are small portions of those in the herbarium of the Berlin Botanical Garden and were received through the courtesy of Dr. I. Urban.

**54. *Muhlenbergia enervis* (Scribn.).**

*Muhlenbergia gracilis* var. *enervis* Scribn.; Beal, Grasses N. Amer. 2: 242. 1896.

Type locality, "Mexico," the type specimen collected on dry ledges, Sierra Madre, Chihuahua, by Pringle (no. 1413).

RANGE: Known only from the type collection.

**55. *Muhlenbergia palmeri* Vasey, Bull. Torrey Club 3: 231. 1886.**

Type locality, "S. W. Chihuahua," the type specimen collected in 1885 by Palmer (no. 16).

RANGE: Known only from mountains of Chihuahua.

**HERBARIUM SPECIMENS:**

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 16 in 1885. Wet places, pine plains, base of Sierra Madre, *Pringle* 1417.

**56. *Muhlenbergia acuminata* Vasey, Bot. Gaz. 11: 337. 1886.**

Type locality, "New Mexico," the type specimen collected by Wright (no. 1993).

RANGE: Mountains of New Mexico and south in the highlands to San Luis Potosí.

**HERBARIUM SPECIMENS FROM MEXICO:**

CHIHUAHUA: Chihuahua, cool slopes, rocky hills, *Pringle* 403.

COAHUILA: San Lorenzo Canyon, *Palmer* 399 in 1904. Saltillo, rich moist soil, *Palmer* 379 in 1898; dry hills, *Palmer* 416 in 1898. Chojo Grande, *Palmer* 341 in 1904.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 969 in 1878.

**57. *Muhlenbergia elongata* Scribn. in Beal, Grasses N. Amer. 2: 251. 1896.**

Type locality, "Mexico," the type specimen collected on "Ledges, rocky hills near Chihuahua" by Pringle (no. 398).

RANGE: Highlands of Chihuahua.



## HERBARIUM SPECIMENS:

CHIHUAHUA: Ledges, rocky hills near Chihuahua, *Pringle* 398. Southwestern Chihuahua, *Palmer* 159 in 1885.

58. *Muhlenbergia berlandieri* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4<sup>1</sup>: 299. 1841.

Type locality, "Mexico, in montibus," the type specimen collected by Berlandier.

RANGE: Texas and New Mexico and south in the highlands to Oaxaca.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Cananea, *Ricketts* 16.

DURANGO: Durango, abundant in a meadow, *Palmer* 729 in 1896.

SAN LUIS POTOSÍ: En route to Tampico, *Palmer* 954 in 1879.

JALISCO: Road between Mezquitic and Monte Escobedo, *Rose* 2614.

HIDALGO: Pachuca, rocky slopes, *Purpus* 1626; rocky hill, *Hitchcock* 6708½.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6886. Federal District, *Pringle* 7376, 9591.

PUEBLA: Chalchicomula, rocky hill, *Hitchcock* 6300, 6301. San Marcos, railway embankment, *Hitchcock* 6524; large clump, sandy soil, *Hitchcock* 6542. Esperanza, rocky hill, *Hitchcock* 6473. Cerros near San Luis, on rocks, *Purpus* 2900. Hills about Contadero Station, *Pringle* 9590.

OAXACA: Sierra de San Felipe, *Conzatti & Gonzáles* 438a.

64. *TRINIOCHLOA* gen. nov.<sup>1</sup>

Spikelets 1-flowered, the rachilla not produced beyond the floret; glumes membranaceous, thin, and papery; lemma narrow, rounded on the back, firmer than the glumes, bearing a stout, geniculate, dorsal awn attached above the middle, 2-toothed at the apex, the teeth slender, the callus densely bearded. Cespitose perennials with narrow, rather few-flowered panicles and spikelets as much as 1 cm. long excluding the awns.—Mountainous regions, Sonora, Mexico, to Ecuador.

Type species, *Podosaemum stipoides* H. B. K.

## KEY TO THE SPECIES.

Glumes much shorter than the lemma. . . . . 1. *T. stipoides*.

Glumes about as long as the lemma.

Blades very narrow, less than 1 mm. wide; glumes unequal, the second about 1 cm. long; ligule as much as 1 cm. long. . . . . 2. *T. micrantha*.

Blades 3 to 4 mm. wide; glumes nearly equal, the second 1.5 cm. long; ligule short. . . . . 3. *T. laxa*.

1. *Triniochloa stipoides* (H. B. K.).

*Podosaemum stipoides* H. B. K. Nov. Gen. & Sp. 1: 131. 1816.

*Muhlenbergia stipoides* Kunth, Rév. Gram. 1: 64. 1829.

*Avena stipoides* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 19: 4. 1900.

Type locality, "in planitie temperata amoena Llano de Cachapamba, juxta Chillo \* \* \* (Regno Quitensi)."

RANGE: High mountains, southern Mexico to Ecuador.

## HERBARIUM SPECIMENS FROM MEXICO:

MÉXICO: Ixtaccihuatl, hillsides, *Purpus* 1628; moist open woods, *Purpus* 1630.

PUEBLA: Mount Orizaba, *Liebmann* 647.

MORELOS: Tres Marías Mountains, *Pringle* 11754.

OAXACA: Sierra de San Felipe, *Pringle* 4905, *Smith* 923.

<sup>1</sup> This genus is dedicated to Karl Bernhard Trinius (1778–1844), the eminent agrostologist, whose herbarium is at the Academy of Sciences of St. Petersburg. *Trinia* Hoffm. is a genus of Umbelliferae, and *Triniusia* Steud., based on *Bromus danthoniae*, is not a valid genus. It is but fitting that the name of Trinius should be borne by a genus of the family to the knowledge of which he contributed so largely.



**2. *Triniochloa micrantha* (Scribn.).**

*Avena micrantha* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 19: 3. f. 1. 1900.

Type locality, "State of Morelos," the type specimen collected at Sierra de Tepoxtlán by Pringle (no. 8018).

RANGE: Known only from the type locality.

**HERBARIUM SPECIMENS:**

MORELOS: Sierra de Tepoxtlán, mossy cliffs, *Pringle* 8018, 9172, 11214.

**3. *Triniochloa laxa* sp. nov.**

Culms densely cespitose, lax, decumbent and rhizomatous at base, the old culms and leaves persistent; sheaths glabrous; ligule 1 to 3 mm. long; blades flat, scabrous, 15 to 30 cm. long, 3 to 4 mm. wide, long-acuminate, smooth and green beneath, scabrous and glaucous above; panicles narrow, few-flowered, scarcely exceeding the upper leaves, the branches few, short and appressed, bearing 1 to 3 spikelets; spikelets excluding the awn about 15 mm. long; glumes narrow, gradually narrowed to the acute apex, purple at base along the midrib, scarious, glabrous, the first 1-nerved, 12 mm. long, the second 3-nerved, 15 mm. long; lemma mottled with purple, rounded on the back, about 14 mm. long, 5-nerved, the three central nerves passing into the dorsal awn, the other two extending into the 2 short teeth of the apex; callus densely bearded with white hairs 3 to 5 mm. long; awn attached about the middle of the lemma and below the short teeth, about 15 mm. long, stout, bent about the middle, loosely twisted below; palea similar to the lemma, nearly as long.

Type in the U. S. National Herbarium, no. 691223, collected on rocky side of ravine, 2,400 meters altitude, Sánchez, Chihuahua, Mexico, October 12; 1910, by A. S. Hitchcock (no. 7687).

RANGE: Known only from the type collection.

**65. LYCURUS H. B. K. Nov. Gen. & Sp. 1: 141. pl. 45. 1816.****KEY TO THE SPECIES.**

First glume bearing a single awn about as long as the body of the

lemma, and often a second shorter awn..... 2. *L. phalaroides*.

First glume bearing 2 slender nearly equal teeth, exceeding the body of the lemma.

Culms smooth..... 1. *L. phleoides*.

Culms scabrous; blades firm, glaucous..... 1a. *L. phleoides glaucifolius*.

**1. *Lycurus phleoides* H. B. K. Nov. Gen. & Sp. 1: 142. pl. 45. 1816.**

Type locality, "in temperatis Mexici, inter Guanaxuato et Temascatio et in radicibus aridissimi montis La Buffa."

RANGE: Rocky Mountain region of the United States and south in the mountains to southern Mexico.

**HERBARIUM SPECIMENS FROM MEXICO:**

LOWER CALIFORNIA: Cape region, mountains, *Brandege* in 1899. Sierra de la Laguna, *Brandege* in 1893.

SONORA: Los Pinitos, *Hartman* 230.

CHIHUAHUA: Sánchez, rocky ravine, *Hitchcock* 7684; along railway, *Hitchcock* 7698. Chihuahua, rocky hill, *Hitchcock* 7793. Southwestern Chihuahua, *Palmer* 2 in 1885. Miñaca, rocky hill, *Hitchcock* 7740. Between Casas Grandes and Sabinal, *Nelson* 6356.

DURANGO: Durango, dry ground, *Hitchcock* 7605; rocky hill, Iron Mountain, *Hitchcock* 7637; hillsides, *Palmer* 526 in 1896.

COAHUILA: Chojo Grande, *Palmer* 339 in 1904. Jaral, *Schumann* 1725.

ZACATECAS: Zacatecas, in gulches of dry sterile hill, *Hitchcock* 7496. Plateado, *Rose* 2794.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7463.

SAN LUIS POTOSÍ: San Luis Potosí, edge of field, *Hitchcock* 5676; *Schaffner* 150; *Parry & Palmer* 939 in 1878.

JALISCO: Guadalajara, *Palmer* 459 in 1886.

QUERÉTARO: Between San Juan del Río and Cadereyta, *Rose, Painter & Rose* 9695.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6702. El Salto, limestone hills, *Pringle* 9571. Mount Ixmiquilpan, *Purpus* 5065.

MÉXICO: Popo Park, open ground, *Hitchcock* 6017. Zapán, *Bourgeau* 442. Federal District, open ground, *Hitchcock* 5933, 5903; *Orcutt* 3677, 4308.

PUEBLA: Chalchicomula, *Rose & Hay* 5801; rocky hill, *Hitchcock* 6283. Tehuacán, *Rose & Hay*, 5821; dry limestone ledges, *Pringle* 6689. Esperanza, barren hills, *Pittier* 420; rocky hill, *Hitchcock* 6478. San Marcos, railway embankment, *Hitchcock* 6535, 6514.

1a. *Lycurus phleoides glaucifolius* Beal, Grasses N. Amer. 2: 271. 1896.

Type locality, "Mexico," the type specimen collected in Chihuahua by *Pringle* (no. 426).

RANGE: Highlands of northern Mexico.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Hills near Chihuahua, *Pringle* 426.

DURANGO: Edge of water hole, *Palmer* 831 in 1896.

2. *Lycurus phalaroides* H. B. K. Nov. Gen. & Sp. 1: 142. 1816.

*Muhlenbergia lycuroides* Vasey; Beal, Grasses N. Amer. 2: 239. 1896.

*Lycurus brevifolius* Scribn.; Beal, Grasses N. Amer. 2: 271. 1896.

Type locality, "in montanis regni Mechoacanensis juxta Valladolid, Alberca de Palangeo et Patzcuaro," Mexico.

RANGE: Northern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandegge* in 1893.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 2 in 1885.

DURANGO: Tepehuanes, *Palmer* 260 in 1906.

ZACATECAS: Hacienda de Cedros, foothills, *Lloyd* 179.

JALISCO: Guadalajara, plains, *Pringle* 2470; prairie near San Pedro, *Hitchcock* 7307; *Palmer* 489 in 1886. Zapotlán, rocky hill, *Hitchcock* 7248, 7259.

HIDALGO: Sierra de Pachuca, *Rose, Painter & Rose* 8800.

MICHOACÁN: Morelia, *Arsène* in 1909. Uruápan, prairie, *Hitchcock* 6967. Jacuaro, along railway, *Hitchcock* 7006.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6893. Federal District, dry soil, *Pringle* 6576.

PUEBLA: Mount Orizaba, rocky slopes, *Seaton* 249.

VERACRUZ: Orizaba, *Botteri* 680.

CHIAPAS: San Cristóbal, *Nelson* 3228.

66. *PEREILEMA* Presl, Rel. Haenk. 1: 233. pl. 37. f. a. 1830.

## KEY TO THE SPECIES.

- Bristles scabrous; clusters oblong or linear, approximate; long awns numerous and often flexuous..... 1. *P. crinitum*.  
 Bristles plumose; inflorescence of several globose clusters, distant at base; long awns few..... 2. *P. ciliatum*.

1. *Pereilema crinitum* Presl, Rel. Haenk. 1: 233. pl. 37. f. a. 1830.

Type locality, "Panama."

RANGE: Northwestern Mexico to South America.



HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San Francisquito Mountains, *Brandegge* in 1890.

TEPIC: Tepic, shady banks of arroyo, *Palmer* 1932 in 1892.

JALISCO: Guadalajara, ledges of barranca, *Pringle* 1744; *Palmer* 499 in 1886; side of gulch near San Pedro, *Hitchcock* 7303; side of Barranca de Oblatos, *Hitchcock* 7340. Chapala, *Rose* 3464.

MICHOACÁN: Sierra Madre, *Langlassé* 603.

VERACRUZ: Escamela, *Bourgeau* 3272. Orizaba, *Müller* 2069; mossy ledges, *Pringle* 6155; *Botteri* 696, 1272. Zacuapan, rocky slopes, *Purpus* 2153.

MORELOS: Cuernavaca, ledges, *Pringle* 11245.

OAXACA: Reyes, *Nelson* 1822. Párian Cañon, dry ledges, *Pringle* 6016.

2. *Pereilema ciliatum* Fourn. Mex. Pl. 2: 93. 1886.

Type locality, Veracruz, "Orizaba" and "Cordova" collections cited.

RANGE: Mountains of southern Mexico.

HERBARIUM SPECIMENS:

JALISCO: Tequila, dry shaded ledges, barranca, *Pringle* 4606.

VERACRUZ: Orizaba, *Botteri* 708, 711.

MORELOS: Cuernavaca, *Pringle* 11243, 11763.

67. *PHLEUM* L. Sp. Pl. 59. 1753.

TIMOTHY.

1. *Phleum alpinum* L. Sp. Pl. 59. 1753.

Type locality, "in Alpibus," Europe.

RANGE: Cooler regions and mountains of the northern hemisphere and extending in the high mountains to South America.

HERBARIUM SPECIMENS FROM MEXICO:

MÉXICO: Nevado de Toluca, *Nelson* 22 in 1893.

PUEBLA: Peak of Orizaba (Citlaltepetl), near timber line, *Purpus* 2886; *Liebmann* 685.

68. *SPOROBOLUS* R. Br. Prodr. Fl. Nov. Holl. 169. 1810.

KEY TO THE SPECIES.

Plants annual.

Glumes unequal, the second as long as the spikelet, the first half as long.....

5. *S. macrospermus*.

Glumes subequal.

Glumes about as long as the spikelet, 2 mm. long, smooth; spikelets often nodding on the capillary pedicels.....

1. *S. shepherdii*.

Glumes shorter than the spikelet, 1 mm. long or less.

Pedicels short, uniformly rather thick, the spikelets appressed along the main branches of the panicle; glumes smooth, very short, obtuse..

3. *S. ramulosus*.

Pedicels capillary.

Pedicels thickened below the spikelet, all longer than the spikelets; panicle more than half the entire height of the plant; glumes often pilose.....

2. *S. confusus*.

Pedicels not conspicuously thickened, the ultimate lateral ones shorter than the spikelets; panicle less than half the height of the plant.....

4. *S. minutiflorus*.



## Plants perennial.

## Plants producing creeping rhizomes.

Inflorescence spike-like; blades firm, pungently involute-pointed..... 21. *S. virginicus*.

Inflorescence a diffuse capillary panicle; blades flat, rather lax.

Ligule 1 to 2 mm. long, auricled..... 6. *S. auriculatus*.

Ligule minute, not auricled..... 7. *S. asperifolius*.

## Plants tufted, not producing creeping rhizomes.

Panicle large and open, the branches ascending, the lower 10 to 15 cm. long.

Blades scabrous, elongated, the tip involute-attenuate; plants 1 to 2 meters high, in large tussocks..... 8. *S. wrightii*.

Blades smooth, glaucous, less than 10 cm. long; plants less than 1 meter high..... 9. *S. palmeri*.

## Panicle narrower or more delicate.

Panicle long and narrow, the branches appressed.

Second glume shorter than the spikelet, little longer than the first; panicle densely flowered; spikelets about 2 mm. long... 17. *S. indicus*.

Second glume about as long as the spikelet.

Panicle narrow but not strict and spike-like; blades, at least the lower, ciliate; sheaths glabrous or sparsely pilose at the throat..... 19. *S. purpurascens*.

Panicle elongated, strict and spike-like; blades not ciliate or only slightly so at base; sheaths strongly pilose at throat..... 10. *S. strictus*.

Panicle pyramidal or oblong, the main branches spreading or ascending (only of the exerted portion in *S. cryptandrus*).

Panicle even at maturity inclosed at base in the uppermost sheath; leaves strongly bearded at the throat.

Branches of panicle flexuous, slender..... 12. *S. flexuosus*.

Branches of panicle not flexuous..... 11. *S. cryptandrus*.

## Panicle exerted at maturity.

Branches of panicle elongated, naked below; blades flat, lax, as much as 1 cm. wide; sheaths ciliate, densely short-pilose on the collar..... 13. *S. buckleyi*.

Branches of panicle not conspicuously elongated.

Spikelets all on slender pedicels; glumes unequal, both shorter than the spikelet..... 14. *S. trichodes*.

Spikelets short-pedicel, more or less secund along the main branches.

Lowermost panicle branches several in a whorl.

Spikelets 1.5 mm. long..... 16. *S. argutus*.

Spikelets 3 mm. long..... 20. *S. erectus*.



Lowermost branches in 1's or 2's.

Panicle long and narrow;  
branches spreading in  
anthesis, spikelet-bear-  
ing nearly to base;  
blades slender, elong-  
ated, attenuate-pointed 18. *S. jacquemontii*.

Panicle pyramidal, the  
branches naked below;  
blades short, flat,  
mostly basal; spikelets  
1 mm. long..... 15. *S. atrovirens*.

**1. *Sporobolus shepherdii* Vasey, Bull. Torrey Club 14: 8. 1887.**

Type locality, "S. W. Chihuahua," the type specimen collected in 1885 by Palmer, probably at Batopilas.

RANGE: Highlands of northern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, rocky pine woods, *Hitchcock* 7679. Sierra Madre, *Pringle* 1424; near Colonia García, *Townsend & Barber* 330. Southwestern Chihuahua, *Palmer* 9 in 1885.

DURANGO: Sandías Station, barranca, *Pringle* 13635.

**2. *Sporobolus confusus* (Fourn.) Vasey, Bull. Torrey Club 15: 293. 1888.**

*Vilfa confusa* Fourn. Mex. Pl. 2: 101. 1886.

Type locality, not definitely given, Jorullo being the first place mentioned ("In devexis arenosis montis ignivomi Jorullo, Bonpl.," [that being the type collection of *Vilfa ramulosa* H. B. K.]); collections from Orizaba, Nevado de Toluca, Jalacingo, and United States also cited.

RANGE: Montana to Washington and south in the mountains to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandeggee* in 1899.

SONORA: Alamos, *Palmer* 696 in 1890.

CHIHUAHUA: Santa Eulalia Mountains, gravelly washes, *Wilkinson* in 1885. Chihuahua, dry bed of river, *Hitchcock* 7783; hills and plains, *Pringle* 482. Southwestern Chihuahua, *Palmer* 4, 4a, 76, and 85 in 1885. Sánchez, open ground in pine woods, *Hitchcock* 7662. Miñaca, sandy bed of dry run, *Hitchcock* 7767.

AGUASCALIENTES: Aguascalientes, gravel in dry run, *Hitchcock* 7472.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 927 in 1878.

JALISCO: Guadalajara, prairie near San Pedro, *Hitchcock* 7276; dry ditch, road to Barranca de Oblatos, *Hitchcock* 7309.

MICHOACÁN: Punguato near Morelia, *Arsène* in 1909.

MÉXICO: Salto de Agua, dry meadows, *Purpus* 1635. Valley of Mexico, *Schaffner* 192; *Rose & Painter* 7128.

PUEBLA: Puebla, *Nicolas* in 1908.

**3. *Sporobolus ramulosus* (H. B. K.) Kunth, Rév. Gram. 1: 68. 1829.**

*Vilfa ramulosa* H. B. K. Nov. Gen. & Sp. 1: 137. 1816.

*Sporobolus racemosus* Vasey, Bull. Torrey Club 14: 9. 1887.

Type locality, "in devexis arenosis montis ignivomi Mexicani, Jorullo."

RANGE: Colorado, Arizona, and southward in the highlands to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandeggee* in 1899.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 4b in 1885. Sánchez, open ground in pine woods, *Hitchcock* 7661. Sierra Madre, cool, gravelly slopes, *Pringle* 1425.

JALISCO: Nevado de Colima, in open ground, *Hitchcock* 7155. Volcán de Colima, *Ross* 511.

MÉXICO: Nevado de Toluca, *Rose & Painter* 6433, 7926. Cima, *Rose & Painter* 8062. Popocatepetl, *Rose & Hay* 6014. Federal District, *Bourgeau* 1028, 1308.

MORELOS: Tres Marías, railroad banks, *Pringle* 10412.

4. *Sporobolus minutiflorus* (Trin.) Link, Hort. Berol. 1: 88. 1827.

*Vilfa minutiflora* Trin. Gram. Unifl. 158. 1824.

Type locality unknown, the species described from a garden specimen.

RANGE: Southern Mexico to South America.

## HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Consoquitla, *Liebmann* 707.

5. *Sporobolus macrospermus* Scribn.; Beal, Grasses N. Amer. 2: 302. 1896.

Type locality, "Mexico (Jalisco)," the type specimen collected by *Pringle* (no. 2447).

RANGE: Southern Mexico and Guatemala.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Zapotlán, hills, *Hitchcock* 7178; rocky hill, *Hitchcock* 7253. Guadalaraja, prairie near San Pedro, *Hitchcock* 7305; hills, *Pringle* 2048; rocky hills, *Pringle* 2447. San Nicolás, sterile clay hill, *Hitchcock* 7204. Etzatlán, dry banks, *Pringle* 11755.

MICHOACÁN: Uruápan, open stony place, *Hitchcock* 6963.

OAXACA: Las Sedas, *Smith* 921; granitic soil, hills, *Pringle* 4943.

CHIAPAS: Roadside between Tuxtla and San Cristóbal, *Nelson* 3120.

6. *Sporobolus auriculatus* Vasey, Contr. U. S. Nat. Herb. 3: 64. 1892.

Type locality, Pena, Texas, the type specimen collected by *Nealley*.

RANGE: Texas to Arizona and Sonora.

## HERBARIUM SPECIMEN FROM MEXICO:

SONORA: Sierra del Nacori, *Lumholtz* 326.

7. *Sporobolus asperifolius* Nees & Meyen, Nov. Act. Acad. Caes. Leop. Carol. 19: Suppl. 1: 141. 1843.

Type locality, "In republica Chilensi, ad Copiapo (circa Nantoco) et Rio Maipu flumina," the type specimen collected by *Meyen*.

RANGE: North Dakota to British Columbia and south in the mountains to South America.

## HERBARIUM SPECIMEN FROM MEXICO:

SAN LUIS POTOSÍ: San Luis Potosí, *Griffiths* 6517.

8. *Sporobolus wrightii* Munro; Scribn. Bull. Torrey Club 9: 103. 1882.

Type locality, "Camp No. 12 on the Little Colorado," Arizona.

RANGE: Alkaline soil, southwestern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandege* in 1890. Playa María, *Anthony* in 1896. San Requis, *Brandege* in 1889. Tía Juana, *Jones* 3746. Topo, *Orcutt* in 1884. Carysito, *Orcutt* in 1884.

SONORA: Along railway, 10 miles south of Nogales, *Hitchcock* 3632.

CHIHUAHUA: Chihuahua, water courses, *Wilkinson* in 1885. Casas Grandes, *Nelson* 6344. Between Colonia García and Pratt's ranch, *Nelson* 6243.

SINALOA: Topolobampo, alkali bottoms, *Palmer* 239 in 1897. Between Rosario and Acaponeta, *Rose* 1867.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

DURANGO: Torreón, near ditch, *Hitchcock* 7551, 7727. Durango, under mesquite trees, alkali land, *Palmer* 742 in 1896.

COAHUILA: Jaral, *Schumann* 1735. Saltillo, dry ground in large, dense tussocks 3 feet in diameter, *Hitchcock* 5581; adobe soil in irrigated field, *Hitchcock* 5595; old plowed land in dry mesas, *Hitchcock* 5644; sandy ground, river bottom, *Hitchcock* 5636; low clay alkaline soil, *Palmer* 1 in 1898.

ZACATECAS: Zacatecas, along dry river bed, *Hitchcock* 7535.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7458; along ditch, *Hitchcock* 7493.

SAN LUIS POTOSÍ: San Luis Potosí, edge of field, *Hitchcock* 5680.

HIDALGO: Valley near Tula, *Pringle* 8616.

FEDERAL DISTRICT: *Rose & Hough* 4887.

9. *Sporobolus palmeri* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 48. pl. 5. 1898.

Type locality, "alkali bottoms near the city of Durango, Mexico," the type specimen collected in 1896 by Palmer (no. 180).

RANGE: Known only from the type collection.

10. *Sporobolus strictus* (Scribn.) Merr. U. S. Dept. Agr. Div. Agrost. Circ. 32: 6. 1901.

*Sporobolus cryptandrus strictus* Scribn. Bull. Torrey Club 9: 103. 1882.

Type locality, "Banks of the Rillita, near Camp Lowell," the type specimen collected by Pringle.

RANGE: Kansas to Nevada and south to northern Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

SONORA: Between Imeris and Santa Ana, *Griffiths* 6962.

11. *Sporobolus cryptandrus* (Torr.) A. Gray, Man. 576. 1848.

*Agrostis cryptandra* Torr. Ann. Lyc. N. Y. 2: 151. 1826.

*Vilfa cryptandra* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3<sup>1</sup>: 69. 1840.

Type locality, "On the Canadian river" [Texas or Oklahoma], the type specimen collected by James.

RANGE: Northern United States to northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Guaymas, *Palmer* 65 in 1887. Las Ranchas, *Rose, Standley & Russell* 15036. Hermosillo, meadow near river, *Hitchcock* 3595; dry bed of Sonora River, *Chase* 5507. Along railway 10 miles south of Nogales, *Hitchcock* 3630. 3639. Nogales to Cocospora Ranch, *Griffiths* 6797.

CHIHUAHUA: Valley near Chihuahua, *Pringle* 419.

COAHUILA: Saltillo, sandy field, river bottom, *Hitchcock* 5625.

NUEVO LEÓN: Monterrey, sandy soil by river, *Hitchcock* 5551.

12. *Sporobolus flexuosus* (Thurb.) Rydb. Bull. Torrey Club 32: 601. 1905.

*Vilfa cryptandra flexuosa* Thurb.; Vasey in Wheeler, Rep. U. S. Surv. 100th Merid. 6: 282. 1878.

Type locality, "Nevada and Arizona" cited.

RANGE: Southwestern United States and northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sand hills near Paso del Norte [Juárez], *Pringle* 815. Colonia Díaz, *Nelson* 6458.

13. *Sporobolus buckleyi* Vasey, Bull. Torrey Club 10: 128. 1883.

Type locality, "Texas," the type specimen collected by Buckley.

RANGE: Texas and eastern Mexico.



## HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Valley of Monterey, *Pringle* 2520. Monterey, edge of thicket along Río San Juan, *Hitchcock* 5558.

TAMAULIPAS: Tampico, *Palmer* 154 in 1910.

14. *Sporobolus trichodes* nom. nov.

*Sporobolus capillaris* Vasey, Contr. U. S. Nat. Herb. 1: 283. 1893, not Miq. 1851.

Type locality, "Río Blanco," the type specimen collected in 1886 by Palmer (no. 512).

RANGE: Highlands of Mexico from Chihuahua to Michoacán.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Guerrero plains, *Pringle* 1426.

JALISCO: Guadalajara, on rocks, side of Barranca de Oblatos, *Hitchcock* 7336; dry ledges, barranca, *Pringle* 3853. Río Blanco, *Palmer* 512 in 1886. Between Mezquitic and Monte Escobedo, *Rose* 2613.

MICHOACÁN: Oeste del Zapote, near Morelia, *Arsène* in 1909.

MORELOS: Cuernavaca, hillside pasture, *Hitchcock* 6819.

15. *Sporobolus atrovirens* (H. B. K.) Kunth, Rév. Gram. 1: 68. 1829.

*Vilfa atrovirens* H. B. K. Nov. Gen. & Sp. 1: 138. 1816.

Type locality, "in valle Mexicana prope El Peñon del Marques."

RANGE: Highlands of Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: El Taste, *Brandeggee* in 1893 and 1902.

DURANGO: Durango, in gardens, fields, and mesquite thickets, *Palmer* 874 in 1896.

TAMAULIPAS: Victoria, *Palmer* 468 in 1907.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 937 in 1878, *Schaffner* 141.

Las Canoás, dry rocky hills, *Pringle* 3130. Cárdenas, rocky hill, *Hitchcock* 5771.

QUERÉTARO: Querétaro, rocky hill, *Hitchcock* 5830, 5858.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6729. El Salto, hills, *Pringle* 11247.

MÉXICO: Toluca, open rocky place, *Hitchcock* 6909. Federal District, *Bourgeau* 535, *Rose & Hay* 5470, 5971, *Pringle* 8727, 9609; open flat places among lava rocks, *Hitchcock* 5956.

PUEBLA: San Luis Tultitlanapa, *Purpus* 3587; Tehuacán, *Rose & Hay* 5923, cactus hill, *Hitchcock* 6080.

VERACRUZ: Orizaba, *Müller* 2092.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6145.

YUCATÁN: Izamal, open lands, *Gaumer* 313.

16. *Sporobolus argutus* (Nees) Kunth, Enum. Pl. 1: 215. 1833.

*Vilfa arguta* Nees, Agrost. Bras. 395. 1829.

Type locality, "locis campestribus provinciae Piauhianae et ad flumen S. Francisci prov. Minarum," Brazil, the type specimen collected by Martius. This species appears to be the same as the one described by Fournier<sup>1</sup> under *Vilfa grisebachiana*. He cites two specimens from Orizaba that I have not seen. However, I consider the type of Fournier's species to be Wright's no. 3427a, which he cites, since he gives as a synonym, "*Sporobolus purpurascens* Griseb. part."

RANGE: Southwestern United States and the West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandeggee* in 1899, *Purpus* 323. Santa Agueda, *Palmer* 224 in 1890. Carmen Island, *Palmer* 856 in 1890.

<sup>1</sup> Mex. Pl. 2: 98. 1886.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

SONORA: Yaqui River, *Palmer* 1 in 1869. Imeris to Santa Ana, *Griffiths* 6856. Guaymas, *Palmer* 160, 165, 188, and 696 in 1887, *Rose, Standley & Russell* 12583; gravel near bay, *Hitchcock* 3554; open gravelly place in yard, *Hitchcock* 3564. Batamotal, *Orcutt* in 1899. Agiabampo, *Palmer* 814 in 1890.

CHIHUAHUA: Chihuahua, sandy plains, *Pringle* 816.

SINALOA: Topolobampo, in open bottom lands, *Palmer* 236 in 1897; *Rose, Standley & Russell* 13289; Mazatlán, hillside near salt water, *Rose, Standley, & Russell* 13715; *Purpus* 359.

DURANGO: Durango, along road, *Hitchcock* 7583; rich moist soil, *Palmer* 384 and 737 in 1896.

COAHUILA: Jaral, *Schumann* 1764. Saltillo, along irrigation ditch, *Hitchcock* 5580.

NUEVO LEÓN: Monterey, along street, *Hitchcock* 5519.

TAMAULIPAS: Victoria, *Palmer* 385 in 1907. Tampico, *Palmer* 144 in 1910; along street, *Hitchcock* 5789; along railway, *Hitchcock* 5783.

SAN LUIS POTOSÍ: Cárdenas, along railway track, *Hitchcock* 5721. Guascama, *Purpus* 5420.

JALISCO: Guadalajara, *Palmer* 294 in 1886. Orozco, common on railway bank, *Hitchcock* 7381.

QUERÉTARO: Querétaro, open dry ground, along road, *Hitchcock* 5855.

HIDALGO: Pachuca, along railway, *Hitchcock* 6758.

FEDERAL DISTRICT: Pasture, *Bourgeau* 449, wet meadows; *Pringle* 9553, along trolley, *Hitchcock* 5876, *Orcutt* 4106.

TLAXCALA: Santa Ana, *Nicolas* in 1908.

PUEBLA: Tehuacán, old field, *Hitchcock* 6032; hard ground, along road, *Hitchcock* 6067; calcareous plains, *Pringle* 6750.

VERACRUZ: Veracruz, along harbor front, *Hitchcock* 6576.

GUERRERO: Acapulco, *Palmer* 74 in 1894.

OAXACA: Tomellín, along railway, *Hitchcock* 6236. Sierra de San Felipe, *Smith* 51.

YUCATÁN: Progreso, *Millsbaugh* 1713.

17. *Sporobolus indicus* (L.) R. Br. Prodr. Fl. Nov. Holl. 1: 170. 1810.

*Agrostis indica* L. Sp. Pl. 63. 1753.

Type locality given as "India."

RANGE: Warmer parts of the Old World, introduced and become common from the southern United States and West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 29 in 1885.

DURANGO: Tepehuanes, *Palmer* 261 in 1906. Durango, moist, black, loamy soil, *Palmer* 193 in 1896; along ditch, *Hitchcock* 7659.

TEPIC: Tepic, common on hillsides, near irrigating ditches, *Palmer* 1923 in 1892. Santa Teresa, *Rose* 2142.

ZACATECAS: Plateado, *Rose* 2708.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 968 in 1878; alfalfa field, *Hitchcock* 5666; irrigation ditch, *Hitchcock* 5678; edge of field, *Hitchcock* 5709. Cárdenas, along railway, *Hitchcock* 5772. Alvarez, *Palmer* 169 in 1904.

JALISCO: Guadalajara, prairie near San Pedro, *Hitchcock* 7288. San Nicolás, cornfield, *Hitchcock* 7226. Zapotlán, railway right of way, *Hitchcock* 7130. Río Blanco, *Palmer* 205 in 1886.

GUANAJUATO: Irapuato, moist ground along railway, *Hitchcock* 7433; moist sandy-clay plain, *Hitchcock* 7403. Acámbaro, along railway, *Hitchcock* 6942.

QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5814.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6740. Ixmiquilpan, river bank, *Rose, Painter & Rose* 9062.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

MICHOACÁN: Uruápan, along road, *Hitchcock* 6969. Morelia, *Arsène* in 1909.

MÉXICO: Popo Park, open woods, *Hitchcock* 6015. Toluca, rocky hill, *Hitchcock* 6890, 6901. Amecameca, fields, *Purpus* 1645. Tlalnepantla, wet meadow, *Rose, Painter & Rose* 8385. Federal District, alkali flat, *Hitchcock* 5880; pasture, *Hitchcock* 5895; banks of ditches, *Bourgeau* 1029; *Schumann* 1754.

PUEBLA: Atlixco, *Nelson* in 1893. Tehuacán, edge of field, *Hitchcock* 6085. San Marcos, erect clumps, sandy soil, *Hitchcock* 6543. Puebla, *Nicolas* in 1909.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6319, 6340, 6345; *Nelson* 42. Córdoba, weed along track, *Hitchcock* 6401. Jalapa, along railway, *Hitchcock* 6597; along stream, *Hitchcock* 6655; *Smith* 1753, 1816.

MORELOS: Cuernavaca, pasture, *Hitchcock* 6827.

OAXACA: Cuicatlán, *Nelson* 1650. Along ditch between Tule and Oaxaca, *Hitchcock* 6171. Valley of Oaxaca, *Conzatti & González* 340. Reyes, *Nelson* 1709. Oaxaca, along road, *Hitchcock* 6162.

CHIAPAS: Ocuilapa, table-lands, *Nelson* 3034. Roadside between Tuxtla and San Cristóbal, *Nelson* 3115.

18. *Sporobolus jacquemontii* Kunth, Rév. Gram. 2: 427. pl. 127. 1831.

Type locality, "in insula St. Domingo," the type specimen collected by Jacquemont.

RANGE: West Indies, Mexico, and Central America.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Veracruz, sandy prairie, *Hitchcock* 6552.

MICHOACÁN: Morelia, *Arsène* in 1908.

19. *Sporobolus purpurascens* (Swartz) Hamilt. Prodr. Pl. Ind. Occ. 5. 1825.

*Agrostis purpurascens* Swartz, Prodr. Veg. Ind. Occ. 25. 1788.

Type locality, "Jamaica."

RANGE: Gulf region of the United States and Mexico, and in the West Indies.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Córdoba, grassy bank, *Hitchcock* 6443. Orizaba, *Botteri* 693. Mirador, *Liebmann* 691 in 1841. Dos Puentes, *Liebmann* 692. Jalapa, *Smith* 1569.

20. *Sporobolus erectus* sp. nov.

Perennial, glabrous throughout, culms cespitose, erect, 60 to 70 cm. high, subcompressed; sheaths somewhat keeled; ligule a ciliate-erose ring 0.5 mm. long, sometimes a few long hairs at the sides; blades flat or becoming involute, somewhat soft and thick, sparsely papillose-hispid with long hairs on the margins, the main culm blades as much as 4 mm. wide and 15 cm. long, the uppermost narrow and involute, 2 to 4 cm. long, those of the innovations slender and involute; panicle narrow, dark brown, 10 to 15 cm. long, 3 to 4 cm. wide, the branches in verticils, slender, ascending, naked below, the lower 2 to 3 cm. long; spikelets glabrous, short-pedicel and appressed along the upper half of the branches, 3 mm. long, the pedicels mostly less than 1 mm. long; glumes unequal, acute, the first 1.5 mm. long, the second as long as the spikelet; lemma and palea equal, the latter at maturity split down the middle by the enlarged caryopsis, each part acute, about 1 mm. wide; grain elliptic, abruptly pointed at each end, 2 mm. long, 1 mm. wide.

Type in the U. S. National Herbarium, no. 691231, collected in a clay cut, 1,400 meters altitude, at Jalapa, Mexico, September 2, 1910, by A. S. Hitchcock (no. 6616).

RANGE: Known only from the type collection.

21. *Sporobolus virginicus* (L.) Kunth, Rév. Gram. 1: 67. 1829.

*Agrostis virginica* L. Sp. Pl. 63. 1753.

*Sporobolus pungens* (Schreb.) Kunth, Rév. Gram. 1: 68. 1829.

Type locality given as "Virginia."



RANGE: Sea coasts from Virginia to Costa Rica and the West Indies; also in Lower California.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Margarita Island, *Brandeggee* in 1889.

SONORA: Guaymas, *Palmer* 338 in 1887.

TAMAULIPAS: Tampico, brackish marsh, *Hitchcock* 5781.

VERACRUZ: Veracruz, sandy beach, *Hitchcock* 6567; sand dunes, *Pringle* 8469.

69. **BLEPHARONEURON** Nash, Bull. Torrey Club **25**: 88. 1898.

1. **Blepharoneuron tricholepis** (Torr.) Nash, Bull. Torrey Club **25**: 88. 1898.

*Vilfa tricholepis* Torr. U. S. Rep. Expl. Miss. Pacif. **4**: 155. 1857.

*Sporobolus tricholepis* Torr.; Coulter, Man. Rocky Mount. 411. 1885.

Type locality, "Sandia mountains, New Mexico."

RANGE: Texas to Colorado and Utah, and south in the mountains to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: San José Mountains, *Mearns* 997.

CHIHUAHUA: Sierra Madre near Colonia García, hillside meadow, *Townsend & Barber* 333. Mapula Mountains, thin soil of summits, *Pringle* 822. South-western Chihuahua, *Palmer* 6 in 1885. Sánchez, rocky pine woods, *Hitchcock* 7670.

DURANGO: Dos Cajetes, side of arroyo, *Palmer* 833 in 1896.

MÉXICO: Cima, *Orcutt* 3796. Ixtaccihuatl, rocks, subalpine region, *Purpus* 1634. Federal District, *Pringle* 6485.

70. **EPICAMPES** Presl, Rel. Haenk. **1**: 235. *pl.* 39. 1830.

KEY TO THE SPECIES.

Inflorescence strict, dense, and spike-like.

Glumes awned; lemma awnless or sometimes awned..... 1. *E. leptoura*.

Glumes awnless.

Glumes exceeding the lemma, 6 to 8 mm. long, acuminate;

panicle mostly dark-colored; ligule elongated..... 2. *E. macroura*.

Glumes shorter than the lemma, 2 to 3 mm. long, obtuse;

panicle pale; ligule short..... 3. *E. rigens*.

Inflorescence often narrow, but not spike-like.

Panicle open, the branches slender, spreading, naked below;

spikelets about 2 mm. long..... 9. *E. bourgaei*.

Panicle narrow, the branches ascending or appressed.

Lemmas villous; glumes usually villous; sheaths usually softly pubescent..... 4. *E. lanata*.

Lemmas not villous; sheaths and glumes smooth or scabrous.

Sheaths not compressed-keeled; ligule long, indurated. 5. *E. ligulata*.

Sheaths compressed-keeled; ligule if long, lax and membranaceous.

Spikelets 2 mm. long, often short-awned; ligule short..... 8. *E. stricta*.

Spikelets about 3 mm. long.

Lemma pubescent on lower half..... 6. *E. pubescens*.

Lemma smooth or pubescent on callus only... 7. *E. robusta*.

Two species of which there is insufficient material are not included in the above key: *E. anomala* Scribn., based on *Pringle's* no. 1423 from the State of Chihuahua (which appears to be an abnormal form of *E. ligulata*) and *E. macrotis* Piper, based on *Rose's* no. 3528 from the State of Zacatecas.



**1. *Epicampes leptoura*** Piper, Proc. Biol. Soc. Washington 18: 143. 1905.

Type locality, "Sierra Madre near Colonia García, Chihuahua, Mexico," the type specimen collected by Townsend & Barber (no. 341).

RANGE: Mountains of Chihuahua.

**HERBARIUM SPECIMENS:**

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 0 and 1 in 1885. Sierra Madre near Colonia García, *Townsend & Barber* 341. Miñaca, dry run, *Hitchcock* 7748, 7749; rocky hill, *Hitchcock* 7750. Sánchez, rocky bed of stream, *Hitchcock* 7686.

**2. *Epicampes macroura*** (H. B. K.) Benth. Journ. Linn. Soc. Bot. 19: 87. 1881.

*Crypsis macroura* H. B. K. Nov. Gen. & Sp. 1: 140. 1816.

Type locality, "in apricis montanis regni Mexicani juxta montem Tolucae."

RANGE: Mountain regions from Chihuahua to Guatemala.

**HERBARIUM SPECIMENS FROM MEXICO:**

CHIHUAHUA: Canyon de San Diego, *Hartman* 803.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 919 and 940 in 1878.

JALISCO: Sayula, *Ox Fiber Brush Co.*, in 1909.

MICHOACÁN: Morelia, *Arsène* in 1909.

MÉXICO: Nevado de Toluca, cool slopes under pines, *Pringle* 4211; *Rose & Painter* 7883. Ixtaccihuatl, rocky places above timber line, *Purpus* 317. Popocatepetl, open mountain side, *Hitchcock* 6002; woods, *Hitchcock* 6010. Salazar, *Rose & Painter* 7051. Cima, *Rose & Painter* 7209. Federal District, *Pringle* 6676; lava fields, *Pringle* 11739, 13628. Eslava, *Holway* 6.

PUEBLA: Mount Orizaba, *Seaton* 161, rocky slopes above timber-line; *Purpus* 3017, *Liebmann* 682; common on the middle stretches of mountain, *Hitchcock* 6259. San Marcos, railway embankment, *Hitchcock* 6528. "San Andres, San Miguel," *Liebmann* 684.

**3. *Epicampes rigens*** Benth. Journ. Linn. Soc. Bot. 19: 88. 1881.

Type locality, California.

RANGE: New Mexico to central California and south on the Pacific slope to Durango.

**HERBARIUM SPECIMENS FROM MEXICO:**

LOWER CALIFORNIA: Sierra de San Francisquito, *Brandegge* 22 and 15 in 1899. Canyon Cantillas, *Orcutt* 1143.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 21 in 1885. Chihuahua, by streams, *Pringle* 417; along aqueduct, *Hitchcock* 7770; along dry run, *Hitchcock* 7773.

DURANGO: Durango, prairie along creek, *Hitchcock* 7615.

**4. *Epicampes lanata*** (H. B. K.) Presl; Kunth, Enum. Pl. 1: 209. 1833.

*Agrostis lanata* H. B. K. Nov. Gen. & Sp. 1: 136. 1829.

Type locality, "in scopulosis regni Mexicani, juxta Villalpando, Santa Rosa et Cerro del Cubilete."

RANGE: Highlands, Chihuahua to Oaxaca.

**HERBARIUM SPECIMENS:**

CHIHUAHUA: Chihuahua, cool slopes, rocky hills, *Pringle* 391.

DURANGO: Durango, rocky hill, *Hitchcock* 7587, 7652.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 933 in 1878, *Schaffner* 190.

PUEBLO: Esperanza, rocky hill, *Hitchcock* 6485.

OAXACA: Las Sedas, *Pringle* 5575.

**5. *Epicampes ligulata*** Scribn.; Vasey, Contr. U. S. Nat. Herb. 3: 58. 1892.

Type locality, "Texas," the type specimen collected at Bandero's Pass by Reverchon (no. 1610).

RANGE: Texas to Arizona and northern Mexico.



## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: San José Mountains, *Mearns* 996, 1649.

CHIHUAHUA: Sánchez, rocky pine woods, *Hitchcock* 7667. Sierra Madre, cool slopes, *Pringle* 1427.

6. *Epicampes pubescens* (H. B. K.) Presl; Kunth, Enum. Pl. 1: 209. 1833.

*Agrostis pubescens* H. B. K. Nov. Gen. & Sp. 1: 136. 1829.

Type locality, "in scopulosis regni Mexicani, juxta Villalpando, Santa Rosa et Cerro del Cubilete."

RANGE: Highlands from Coahuila to Oaxaca.

## HERBARIUM SPECIMENS:

COAHUILA: San Lorenzo Canyon, *Palmer* 401 in 1904.

OAXACA: Sierra de San Felipe, summit ledges, *Pringle* 5576.

7. *Epicampes robusta* Fourn. Mex. Pl. 2: 89. 1886.

Type locality, southern Mexico, three localities being cited as follows: "Supra Tacubaya. (BOURG. n. 683); Santa Fe \* \* \*. (BOURG. n. 1153); Cuernavaca (HAHN n. 420)."

RANGE: Highlands from northwestern Mexico to Oaxaca.

## HERBARIUM SPECIMENS:

SONORA: Alamos, *Palmer* 414 in 1891.

CHIHUAHUA: Sánchez, rocky pine woods, *Hitchcock* 7669½. Casas Grandes, *Townsend & Barber* 357.

DURANGO: Otinapa, *Palmer* 344 in 1906.

JALISCO: Río Blanco, *Palmer* 518 in 1886. Zapotlán, hills, *Hitchcock* 7173. Guadalajara, open dry ground, side of Barranca de Oblatos, *Hitchcock* 7335. Balafios, *Rose* 2997. Sierra Madre west of Bolaños, *Rose* 3003.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6708.

MICHOACÁN: Morelia, *Arsène* in 1909. Lomas de la Huerta, *Arsène* in 1909.

MÉXICO: Santa Fé, *Rose & Painter* 8009, 8010. Salto de Agua, rocky hillside, *Purpus* 1623, 1624. Without locality, *Schumann* 1754. Federal District, lava rock, *Hitchcock* 5939; *Bourgeau* 683, 1153; lava fields, *Pringle* 9077; near Chapultepec Castle, *Hitchcock* 7839; *Orcutt* 4317.

PUEBLA: Acatzinco, *Nicolas* in 1909.

OAXACA: Reyes, *Nelson* 1778. Oaxaca, rocky hill, *Hitchcock* 6141.

8. *Epicampes stricta* Presl, Rel. Haenk. 1: 235. pl. 39. 1830.

Type locality, "Mexico."

RANGE: Highlands of central and southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, slopes of canyons, *Pringle* 2321, 11746. Zapotlán, hills, *Hitchcock* 7172.

PUEBLA: Cholula, *Nicolas* in 1909.

VERACRUZ: Orizaba, *Müller* 2130, *Botteri* 647.

OAXACA: Sierra de San Felipe, *Conzatti* 2534.

9. *Epicampes bourgaei* Fourn. Mex. Pl. 2: 88. 1886.

Type locality, "Escamela pr. Orizaba," the type specimen collected by *Bourgeau* (no. 2973).

RANGE: Highlands of central and southern Mexico.

## HERBARIUM SPECIMENS:

JALISCO: Zapotlán, hills, *Hitchcock* 7180, 7247. Guadalajara, cliffs of barrancas, *Pringle* 3335, 11738. Balafios, *Rose* 3002.

VERACRUZ: Orizaba, *Botteri* 729, open rocky hill, *Hitchcock* 6348. Mirador, *Liebmann* 676, 678.

OAXACA: Reyes, *Nelson* 1779. Oaxaca, rocky hill, *Hitchcock* 6154.



71. **POLYPOGON** Desf. Fl. Atlant. 1: 66. 1798.

## KEY TO THE SPECIES.

- Plants annual; inflorescence a compact spike-like panicle;  
glumes 2-lobed at apex..... 1. *P. monspeliensis*.  
Plants perennial; glumes tapering into the awn, not lobed.  
Panicles spike-like, culms spreading or decumbent; glumes  
about 2 mm. long..... 2. *P. littoralis*.  
Panicles narrow but loose, more or less interrupted at base,  
usually 20 to 30 cm. long; glumes about 3 mm. long... 3. *P. elongatus*.

1. **Polypogon monspeliensis** (L.) Desf. Fl. Atlant. 1: 67. 1798.

*Alopecurus monspeliensis* L. Sp. Pl. 61. 1753.

Type locality, Montpellier, France.

RANGE: Pacific slope from Alaska to Mexico; occasional on the Atlantic coast; introduced from Europe.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Tecate River, near Monument no. 245, *Schoenfeldt* 3730.

Nachognero Valley, *Mearns* 3370. Northern Lower California, *Orcutt* in 1886.

CHIHUAHUA: Banks of Río Galleana, in the pueblo, *Hartman* 661.

2. **Polypogon littoralis** (With.) Smith, Comp. Fl. Brit. 13. 1800.

*Agrostis littoralis* With. Bot. Arr. Veg. Brit. ed. 3. 2: 129. 1796.

Type locality, "Wells, on the Norfolk coast," England.

RANGE: Vancouver Island to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

PUEBLA: Tehuacán, by streams, *Pringle* 6772; along ditch, *Hitchcock* 6039.

Puebla, *Nicolas* in 1909.

3. **Polypogon elongatus** H. B. K. Nov. Gen. & Sp. 1: 134. 1816.

Type locality, "in temperatis regni Quitensis prope Chillo."

RANGE: Northern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

DURANGO: Durango, shaded edge of water ditch, *Palmer* 162 in 1896. Nombre de Dios, edge of a water canal, *Palmer* 111 in 1896. San Ramón, *Palmer* 76 in 1906.

COAHUILA: Saltillo, along ditches, *Palmer* 2 in 1898, *Hitchcock* 5651.

SAN LUIS POTOSÍ: San Luis Potosí, irrigation ditch in or near the water, *Hitchcock* 5684.

GUANAJUATO: Irapuato, along ditch, *Hitchcock* 7435.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5816.

FEDERAL DISTRICT: Wet meadows, *Pringle* 8508; along ditch, *Hitchcock* 5886, 5927. Valley of Mexico, *Bourgeau* 216.

PUEBLA: Chinantla, *Liebmann* 617.

VERACRUZ: Orizaba, *Mohr* in 1857.

MORELOS: Cuernavaca, ditch, *Hitchcock* 6848.

OAXACA: Along ditch between Tule and Oaxaca, *Hitchcock* 6179.

72. **CINNA** L. Sp. Pl. 5. 1753.1. **Cinna poaeformis** (H. B. K.) Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 21. 1901.

*Deyeuxia poaeformis* H. B. K. Nov. Gen. & Sp. 1: 146. 1816.

Type locality, "in regno Mexicano, in radicibus montis ignivomi Jorullo."

RANGE: Highlands, southern Mexico to Costa Rica.



## HERBARIUM SPECIMENS FROM MEXICO:

HIDALGO: Sierra de Pachuca, *Pringle* 9554.MÉXICO: Popocatepetl, open woods, *Hitchcock* 5980; *Rose & Hay* 6025, 6036.Sierra de las Cruces, cool moist soil, *Pringle* 4184, 11737. Cima, *Orcutt* 3790.Federal District, *Bourgeau* 912.PUEBLA: Pico de Orizaba, *Liebmann* 723.OAXACA: Sierra de San Felipe, *Smith* 936.

## 73. AGROSTIS L. Sp. Pl. 61. 1753.

## KEY TO THE SPECIES.

Palea evident, 2-nerved.

Panicle narrow, contracted, the branches short, ascending, spikelet-bearing from near the base.. 1. *A. stolonifera*.Panicle open, the branches spreading, naked at base.. 2. *A. rosei*.

Palea wanting or a small nerveless scale.

Panicle narrow, rather compact, the branches ascending, spikelet-bearing from near the base.

Glumes awned; lemma bearing a geniculate, exserted awn..... 4. *A. microphylla*.

Glumes often acuminate but not awned.

Lemma awned..... 5. *A. tolucensis*.Lemma awnless..... 6. *A. exarata*.

Panicle open or somewhat contracted, the branches, at least the principal ones, naked on the lower part.

Lemma bearing an exserted awn; glumes 4 mm. long, lower branches of panicle 4 or 5 in a whorl, slender, spreading, naked below... 9. *A. setifolia*.

Lemma awnless.

Palea one-fourth to half as long as lemma; culms tall and slender; blades flat; panicle open but narrow, the branches ascending, naked at base, with occasional short branches intermixed.... 3. *A. schiedeana*.

Palea minute or wanting.

Culms decumbent at base, numerous, leafy; panicle open, the slender branches branching about the middle..... 8. *A. perennans*.

Culms erect.

Blades long, lax, flat; ligule as much as 5 mm. long; culms tall and slender; panicle open, oblong, the naked portion of the lower branches as much as 4 cm. long ..... 10. *A. schaffneri*.

Blades short, erect; ligule 1 to 3 mm. long; panicle very diffuse, the branches capillary.

Plants tufted, without rhizomes, usually not over 30 cm. high; blades at base of plant often numerous and



fine; naked portion of lower branches of panicle long and capillary, spikelet-bearing toward the extremities..... 7. *A. hiemalis*.

Plants tall and slender, bearing short rhizomes; branches of panicle shorter..... 7a. *A. hiemalis subrepens*.

1. *Agrostis stolonifera* L. Sp. Pl. 62. 1753.

*Agrostis verticillata* Vill. Prosp. Pl. Dauph. 16. 1779.

Type locality given as "in Europa."

RANGE: Southwestern United States to South America, and warmer parts of the Old World.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Maleje, Gulf of California, *Palmer* 41 in 1887. Santa Agueda, *Palmer* 221 in 1890. Nachognero Valley, *Schoenfeldt* 3478. Cedros Island, *Palmer* 666 in 1889.

CHIHUAHUA: Chihuahua, *Palmer* 29 and 160 in 1908.

DURANGO: Durango, beside pond, *Hitchcock* 7571; along water courses, sometimes in shallow water, *Palmer* 179 in 1896. Nombre de Dios, along ditches and streams, *Palmer* 95 in 1896.

COAHUILA: Saltillo, *Palmer* 527 in 1905; wet places along ditches, *Palmer* 806 in 1898; by wet irrigation ditch, *Hitchcock* 5598.

NUEVO LEÓN: Monterey, along irrigation ditch, *Hitchcock* 5577.

ZACATECAS: Zacatecas, moist spot along dry river bed, *Hitchcock* 7529.

SAN LUIS POTOSÍ: Cárdenas, irrigation ditch, *Hitchcock* 5741.

JALISCO: Guadalajara, *Palmer* 230 in 1886.

GUANAJUATO: León, *Hartweg*. 247.

QUERÉTARO: Querétaro, along irrigation ditch, *Hitchcock* 5824.

HIDALGO: Ixmiquilpan, river bank, *Rose, Painter & Rose* 9063. Pachuca, sandy river bed, *Hitchcock* 6767.

MICHOACÁN: Morelia, *Arsène* 3316.

MÉXICO: Valley of Mexico, *Pringle* 9596. Toluca, along ditch, *Hitchcock* 6915. Federal District, along ditch, *Hitchcock* 5881; *Bourgeau* 224.

PUEBLA: Mount Orizaba, *Seaton* 192. Tehuacán, along ditch, *Hitchcock* 6040. Chalchicomula, *Nelson* 248. Puebla, *Nicolas* in 1909.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6335.

OAXACA: San Pedro Nolasco, *Galeotti* 5855, 5884, 5885. Valley of Oaxaca, *Nelson* 1305. Along ditch between Tule and Oaxaca, *Hitchcock* 6180.

2. *Agrostis rosei* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 21. f. 5. 1901.

Type locality, "Sierra Madre Mountains, State of Zacatecas," the type specimen collected by Rose (no. 2373).

RANGE: Known only from the type collection.

3. *Agrostis schiedeana* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4<sup>1</sup>: 327. 1841. Type locality, "Mexico."

RANGE: British Columbia to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

DURANGO: Durango, low wet places in alkaline bottoms, *Palmer* 190 in 1896.

MÉXICO: Sierra de las Cruces, wet banks, *Pringle* 4485. Federal District, pasture, *Hitchcock* 5298; along irrigation ditch in or near the water, *Hitchcock* 5900, 5915, 5920, 5927½; swamps, *Pringle* 11209.



**4. *Agrostis microphylla* Steud. Syn. Pl. Glum. 1: 164. 1854.**

Type locality, western North America (probably Oregon), the type specimen collected by Douglas.

RANGE: British Columbia to Lower California.

HERBARIUM SPECIMEN FROM MEXICO:

LOWER CALIFORNIA: Guadalupe Ranch, *Orcutt* in 1886.

**5. *Agrostis tolucensis* H. B. K. Nov. Gen. & Sp. 1: 135. 1816.**

Type locality, "in apricis aridis regni Mexicani, prope urbem Toluca et Islahuaca."

RANGE: Southern Mexico.

HERBARIUM SPECIMENS:

JALISCO: Nevado de Colima, open ground among shrubs, *Hitchcock* 7157.

MICHOACÁN: Sierra de San Andrés, *Ross* 383.

MÉXICO: Nevado de Toluca, *Pringle* 5202, *Rose & Painter* 8016. Cima, *Orcutt* 3789. Sierra de las Cruces, cool wooded slopes, *Pringle* 4219. Ixtaccihuatl, rocky soil, *Purpus* 224; near glaciers, *Purpus* 1616, 3770; subalpine region, *Purpus* 1643. Popocatepetl, *Rose & Hay* 6296, 6300; wet places along trail, *Hitchcock* 5983; steep bank, *Hitchcock* 5991; in ditch along trail, *Hitchcock* 6006.

PUEBLA: Mount Orizaba, rocky slopes, subalpine region, *Purpus* 3014; *Liebmann* 701, *Ross* 1263.

**6. *Agrostis exarata* Trin. Gram. Unifl. 207. 1824.**

*Agrostis bourgaei* Fourn. Mex. Pl. 1: 95. 1886.

Type locality, "Unalaschka," the type specimen collected by Eschscholz.

RANGE: Alaska to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sierra Madre, by springs, *Pringle* 1421.

DURANGO: San Ramón, *Palmer* 535 in 1906.

MÉXICO: Tultenango, *Rose & Hay* 5421.

**7. *Agrostis hiemalis* (Walt.) B. S. P. Prel. Cat. N. Y. 68. 1888.**

*Cornucopiae hiemalis* Walt. Fl. Carol. 73. 1788.

Type locality, presumably South Carolina.

RANGE: Alaska to Labrador and south to Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, along dry bed of stream, *Hitchcock* 7680. Madera, *Palmer* 263 in 1908.

DURANGO: San Ramón, *Palmer* 82 in 1906. Tobar, *Palmer* 243 in 1906.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 923 in 1878; *Schaffner* 140.

**7a. *Agrostis hiemalis subrepens* Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 44. 1905.**

Type locality, "pine plains, base of Sierra Madre Mountains, State of Chihuahua," the type specimen collected by *Pringle* (no. 1420).

RANGE: New Mexico to Nevada, south to Venezuela.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, along railway near Continental Divide, *Hitchcock* 7721. Base of Sierra Madre, wet places, pine plains, *Pringle* 1420; Colonia García, *Townsend & Barber* 276, *Nelson* 6195.

**8. *Agrostis perennans* (Walt.) Tuckerm. Amer. Journ. Sci. 45: 44. 1843.**

*Cornucopiae perennans* Walt. Fl. Carol. 74. 1788.

RANGE: Northeastern United States to Veracruz.



## HERBARIUM SPECIMENS FROM MEXICO:

PUEBLA: Tezuitlán, *Orcutt* 3953.

VERACRUZ: Orizaba, in old field, hilltop, *Hitchcock* 6388; *Botteri* 687. Mirador, *Liebmann* 714. Jalapa, railway cut through jungle, *Hitchcock* 6640; clay cut along railway, *Hitchcock* 6615.

9. *Agrostis setifolia* Fourn. Mex. Pl. 2: 97. 1886.

Type locality, "In monte Orizabensi," the type specimen collected by *Liebmann* (no. 712).

RANGE: Southern Mexico.

## HERBARIUM SPECIMENS:

PUEBLA: Mount Orizaba, sandy soil, subalpine region, *Purpus* 3013.

OAXACA: Sierra de San Felipe, *Pringle* 4895, *Smith* 922.

10. *Agrostis schaffneri* Fourn. Mex. Pl. 2: 94. 1886.

Type locality, "Tacubaya," Federal District, the type specimen collected by *Schaffner*.

RANGE: Southern Mexico.

## HERBARIUM SPECIMENS:

MÉXICO: Popocatepetl, open place, *Hitchcock* 5990; bank of deep cut, *Hitchcock* 5978. Amecameca, dry hills, *Purpus* 1646. Tres Mariás, *Orcutt* 4441.

PUEBLA: Mount Orizaba, open woods, *Hitchcock* 6262.

74. *CALAMAGROSTIS* Adans. Fam. Pl. 2: 31, 530. 1763.

## KEY TO THE SPECIES.

- Blades flat; panicle rather compact; rhizomes present, the culms  
not densely tufted..... 1. *C. pringlei*.  
Blades involute; culms densely tufted.  
Lemma villous all over..... 2. *C. schiedeana*.  
Lemma not villous or only at base; awn present or absent;  
pedicel one-third to three-fourths as long as lemma..... 3. *C. toluensis*.

1. *Calamagrostis pringlei* (Scribn.) Beal, Grasses N. Amer. 2: 345. 1896.

*Deyeuxia pringlei* Scribn.; Beal, Grasses N. Amer. 2: 345. 1896, as synonym.

Type locality, "Mexico," the type specimen collected in the Sierra Madre, Chihuahua, 2,700 meters altitude, by *Pringle* (no. 1422).

RANGE: Known only from the type collection.

2. *Calamagrostis schiedeana* (Rupr.) Steud.; Fourn. Mex. Pl. 2: 105. 1886.

*Deyeuxia schiedeana* Rupr.; Fourn. Mex. Pl. 2: 105. 1886.

Type locality, "prope fines nivis aeternae in monte Orizabensi," the type specimen collected by *Schiede* (no. 917).

RANGE: Known only from the region of Mount Orizaba.

## HERBARIUM SPECIMENS:

PUEBLA: Mount Orizaba, sandy plains, *Seaton* 227; subalpine in sandy soil, *Purpus* 3016; rocky slopes, alpine region, *Purpus* 3019; *Liebmann* 721; *Pringle* 9593; bald hills, common, *Hitchcock* 6253; *Rose & Hay* 5775; *Ross* 1261, 1274.

3. *Calamagrostis toluensis* (H. B. K.) Trin. in Steud. Nom. Bot. ed. 2. 1: 251. 1840.

*Deyeuxia toluensis* H.B.K. Nov. Gen. & Sp. 1: 143. 1816.

Type locality, "in alta planitie Mexicana juxta Toluca."

RANGE: Mountains of southern Mexico and Guatemala.



## HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Nevado de Colima, hillside, *Hitchcock* 7160; large bunches in partially open ground, hillside, *Hitchcock* 7162, 7163, 7164; above timber line, *Hitchcock* 7168. Volcano of Colima, *Jones* 478.

MÉXICO: Popocatepetl, *Hitchcock* 5982½; open hillsides about snow line, *Hitchcock* 6000; *Rose & Hay* 5981, 6298, 6298a; *Purpus* 3769; *Ross* 1418. Ixtacihuatl, above timber line, *Purpus* 3769. Nevado de Toluca, *Pringle* 4243, *Ross* 504.

PUEBLA: Mount Orizaba, open woods, *Hitchcock* 6265; *Liebmann* 722.

OAXACA: Sierra de San Felipe, under pines of summit ridges, *Pringle* 4726.

This species includes several rather diverse forms which I have been unable to separate satisfactorily. The size of the spikelets and the length of the awn and of the pedicel are variable.

75. **DESCHAMPSIA** Beauv. Ess. Agrost. 91. pl. 8. f. 3. 1812.

## KEY TO THE SPECIES.

Plants annual.....:..... 1. *D. danthonioides*.

Plants perennial.

Panicle spike-like; awn geniculate, twisted below..... 2. *D. pringlei*.

Panicle open; awn straight, not twisted.

Lemma 2 mm. long; branches of panicle remote, slender, appressed..... 3. *D. elongata*.

Lemma 3 to 4 mm. long; branches of panicle short, the lower spreading.

Glumes 5 mm. long; basal blades fine and lax, acute but not pungent..... 4. *D. liebmänniana*.

Glumes 7 mm. long; basal blades spongy, pungent-pointed, rather stiff..... 5. *D. straminea*.

1. **Deschampsia danthonioides** (Trin.) Munro; Benth. Pl. Hartw. 342. 1857.

*Aira danthonioides* Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1: 57. January, 1830.

*Deschampsia calycina* Presl, Rel. Haenk. 1: 251. 1830.

Type locality, western North America.

RANGE: Alaska to Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Palm Valley, *Orcutt* 1272. Tía Juana, mesas, *Orcutt* in 1885. Guadalupe Ranch, *Orcutt* in 1886.

2. **Deschampsia pringlei** Scribn. Proc. Acad. Phila. 1891: 300. pl. 13. f. 1, 1a. 1892.

Type locality, "wet places, pine plains, at the base of the Sierra Madre in the State of Chihuahua," the type specimen collected by *Pringle* (no. 1429).

RANGE: Highlands from Chihuahua to Puebla.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Miñaca, dry run, *Hitchcock* 7762. Base of Sierra Madre, wet places, pine plains, *Pringle* 1429.

DURANGO: Durango, along creek, *Hitchcock* 7617.

SAN LUIS POTOSÍ: San Luis Potosí, irrigation ditch, *Hitchcock* 5685.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6730, 6737.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6889.

PUEBLA: Chalchicomula, rocky hill, *Hitchcock* 6279. San Marcos, railway embankment, *Hitchcock* 6522. Esperanza, rocky hill, *Hitchcock* 6476.



3. *Deschampsia elongata* (Hook.) Munro; Benth. Pl. Hartw. 342. 1857.

*Aira elongata* Hook. Fl. Bor. Amer. 2: 243. pl. 288. 1840.

Type locality, "Sandy islands of the River Columbia," the type specimen collected by Douglas.

RANGE: Alaska to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

MÉXICO: Sierra de las Cruces, wet banks, *Pringle* 4743. Federal District, *Pringle* 13244.

4. *Deschampsia liebmanniana* (Fourn.).

*Deyeuxia liebmanniana* Fourn. Mex. Pl. 2: 106. 1886.

Type locality, not definitely given, three collections cited as follows: "In monte Orizabensi \* \* \* (LIEBM. n. 610 \* \* \* ); in summo Cofre de Perote, \* \* \* (HAHN); prope Tlapacoya (HAHN)."

RANGE: Southern Mexico.

HERBARIUM SPECIMEN:

MÉXICO: Nevado de Toluca, by brooks, *Pringle* 4242.

5. *Deschampsia straminea* sp. nov.

Culms cespitose, sometimes decumbent or rhizomatous at base, glabrous, 20 to 35 cm. high; leaves mostly basal, stramineous, shining, glabrous except the margins of the blades; sheaths loose and papery; ligule about 1 cm. long, thin; blades involute, somewhat spongy in texture, pungent-pointed, 5 to 10 cm. long or the uppermost shorter; panicle purple, ovoid in outline, 7 to 12 cm. long, open, the lower branches in twos or threes, 2 to 5 cm. long, slender, flexuous, spreading, smooth; spikelets somewhat crowded toward the ends of the branches, 2-flowered, the rachilla produced as a hairy bristle; glumes equal, about 7 mm. long, acute, narrowed below, broadest about the middle, glabrous, slightly scabrous on the keels above, more or less 3-nerved, purple, yellowish toward the apex; lemma thin, glabrous, 4 mm. long, 5-nerved, 4-toothed at the thin or erose apex, the awn attached just above the base, straight, slightly exceeding the lemma; callus and rachilla joint long-pilose, the hairs 2 mm. long, the prolongation of the rachilla about half the length of the lemma.

This species is allied to *D. caespitosa*, but the spikelets are larger and the plants touter in proportion to their height.

Type in the U. S. National Herbarium, no. 691237, collected on rocks, alpine region sof Ixtaccihuatl, Mexico, October, 1905, by C. A. Purpus (no. 1619).

The only other collection seen is from "Rocky slopes, alpine region, Mt. Orizaba," *Purpus* 3018.

76. **TRisetum** Pers. Syn. Pl. 1: 97. 1805.

KEY TO THE SPECIES.

- Plants annual; panicle narrow, interrupted..... 3. *T. californicum*.  
Plants perennial.  
Panicle spike-like, often interrupted at base.  
\* Lemma and awn glabrous or nearly so..... 1. *T. spicatum*.  
Lemma villous; awn somewhat plumose..... 2. *T. rosei*.  
Panicle open or, if narrow, not spike-like.  
Second glume broad, abruptly acute.  
Blades mostly basal, involute, capillary, flexuous.. 8. *T. filifolium*.  
Blades scattered, flat.  
Plant tall and stout, 1 to 2 meters high; panicle large, 15 to 30 cm. long..... 10. *T. virletii*.  
Plant low and slender, mostly less than 0.5 meter high; panicle narrow, mostly less than 10 cm. long..... 9. *T. fournieranum*.



Second glume narrow, similar to the first, gradually narrowed to the acute apex.

Rachilla copiously pilose, the hairs 2 mm. long; blades flat.

Sheaths glabrous or scabrous..... 4. *T. deyeuxioides*.

Sheaths velvety-pubescent..... 5. *T. evolutum*.

Rachilla sparsely pilose, the hairs less than 1 mm. long.

Apex of lemma with 4 slender teeth, ligule short; panicle open..... 7. *T. viride*.

Apex of lemma erose; ligule of upper leaf about 4 mm long; panicle rather narrow..... 6. *T. palmeri*.

**1. *Trisetum spicatum* (L.) Richt. Pl. Eur. 1: 59. 1890.**

*Aira spicata* L. Sp. Pl. 64. 1753.

Type locality, "in Lapponiæ alpibus."

RANGE: Arctic regions of the northern hemisphere, southward in the higher mountains to the southern hemisphere.

HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Nevado de Colima, summit, *Hitchcock* 7165; just above timber line, *Hitchcock* 7166.

HIDALGO: Sierra de Pachuca, *Pringle* 9603.

MÉXICO: Nevado de Toluca, *Nelson* 17; in the crater, *Pringle* 4303. Popocatepetl, woods, *Hitchcock* 5995, 6009; *Ross* 1418a; *Rose & Hay* 6299; Ixtaccihuatl, above timber line, *Purpus* 1617, 1643.

PUEBLA: Mount Orizaba, *Seaton* 191; between timber and snow lines, *Hitchcock* 6258; *Rose & Hay* 5734; *Liebmann* 604; alpine region, *Ross* 12700. Vaquería del Jacal, *Liebmann* 605. Chinantla, *Liebmann* 606.

**2. *Trisetum rosei* Scribn. & Merr. Contr. U. S. Nat. Herb. 8: 289. 1905.**

Type locality, "Mount Popocatepetl, at an altitude of 3,600 meters," the type specimen collected by *Rose & Hay* (no. 6016).

RANGE: High mountains of southern Mexico.

HERBARIUM SPECIMENS:

HIDALGO: Trinidad Iron Works, pine forests, *Pringle* 10032. Between Pachuca and Real del Monte, *Rose, Painter & Rose* 8686.

MÉXICO: Popocatepetl, alpine region, *Ross* 1422; snow line, *Purpus* 5067, *Rose & Hay* 5979, 6016; black sand barrens, *Hitchcock* 5987.

PUEBLA: Mount Orizaba, bald hill, *Hitchcock* 6252; open ground, *Hitchcock* 6261; *Rose & Hay* 6348.

**3. *Trisetum californicum* Vasey, U. S. Dept. Agr. Div. Bot. Bull. 12<sup>1</sup>: pl. 46. 1892.**

Type locality, "Lower California near the boundary," the above cited plate being drawn from the two specimens mentioned below.

RANGE: Known only from Lower California.

HERBARIUM SPECIMENS:

LOWER CALIFORNIA: Northern Lower California, *Orcutt* 1431. San Ramón, *Orcutt* 1437.

**4. *Trisetum deyeuxioides* (H. B. K.) Kunth, Rév. Gram. 1: 102. 1829.**

*Avena deyeuxioides* H. B. K. Nov. Gen. & Sp. 1: 147. 1816.

Type locality, "in uliginosis temperatis ad ripam Lacus Tezcucensis" [Lake Texcoco, State of Mexico].

RANGE: Highlands, northern Mexico to Colombia.



## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 14 in 1885. Mapula Mountains, wet banks of streams, *Pringle* 821. Canyons of the Sierra Madre, springy banks, *Pringle* 1432. Sánchez, rocky pine woods near bed of stream, *Hitchcock* 7676.

JALISCO: Guadalajara, *Palmer* 210 in 1886. San Pedro, along ditch, *Hitchcock* 7296; prairie, *Hitchcock* 7302.

MICHOACÁN: Uruápan, along road, *Hitchcock* 6964. Morelia, *Arsène* 2921.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6902; along ditch, *Hitchcock* 6920. Popo Park, moist soil, *Hitchcock* 5966. Federal District, edge of field near ditch, *Hitchcock* 5914; wet meadows, *Pringle* 8512.

PUEBLA: Chinantla, *Liebmann* 733, 735; Chalchicomula, rocky hill, *Hitchcock* 6285. Cholula, *Nicolas* in 1911.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6331.

OAXACA: West slope of Zempoaltepec, *Nelson* 554.

5. *Trisetum evolutum* (Fourn.).

*Deyeuxia evoluta* Fourn. Bull. Soc. Bot. France 24: 181. 1877.

Type locality not given in the original publication, Mirador and Orizaba cited in Mexicanas Plantas.

RANGE: Highlands of central and southern Mexico.

## HERBARIUM SPECIMENS:

SAN LUIS POTOSÍ: Las Canoas, clay bank, *Hitchcock* 5755.

MICHOACÁN: Pátzcuaro, dry hills, *Pringle* 3950.

MÉXICO: Salto de Agua, dry places, *Purpus* 1632.

• VERACRUZ: Jalapa, along ditch, *Hitchcock* 6596. Orizaba, open rocky hill, *Hitchcock* 6351. Mirador, *Liebmann* 730.

GUERRERO: Between Ayusinapa and Petatlán, *Nelson* 2123.

6. *Trisetum palmeri* sp. nov.

Culms cespitose, slender, glabrous, 60 to 100 cm. high; sheaths glabrous or somewhat scabrous; ligule 3 to 4 mm. long; blades elongated, nearly or quite equaling the panicle, 1 to 3 mm. wide, soon involute, scabrous; panicle loose, narrow, 10 to 20 cm. long, the branches several in rather distant whorls, ascending, the shorter ones spikelet-bearing nearly to the base, the longer 5 cm. long, naked below; spikelets, excluding the awns, 5 to 6 mm. long, 2-flowered, the rachilla prolonged as a plumose bristle; glumes about 4 mm. long, narrow, tapering to an acute apex, green along the midnerve, the margins scarious, glabrous except the scabrous keel, the first 1-nerved, the second 3-nerved; lemmas about 4 mm. long, rounded on the back, 5-nerved, scabrous, scarious-tipped, the apex erose, obtuse, 2-lobed, the awn of each lemma geniculate, 5 to 6 mm. long, exserted, attached about the middle; palea slightly exceeding the lemma; callus and rachilla joints pilose with short hairs, the prolongation of the rachilla about one-third as long as the upper floret.

As the genera *Trisetum* and *Deschampsia* are usually distinguished, this species would be referred to the latter, as it has 2-flowered spikelets with obtusely 2-lobed lemmas rounded on the back; but the narrow lemmas exceeding the glumes appear to ally it more closely to certain species of *Trisetum*.

Type in the U. S. National Herbarium, no. 571365, collected at Otinapa, Durango, July 25 to August 5, 1906, by Palmer (no. 342).

RANGE: Known only from Durango.

## HERBARIUM SPECIMENS:

DURANGO: San Ramón, *Palmer* 128 in 1906. Otinapa, *Palmer* 342 and 350 in 1906.

7. *Trisetum viride* (H. B. K.) Kunth, Rév. Gram. 1: 101. 1829.

*Avena viridis* H. B. K. Nov. Gen. & Sp. 1: 147. 1816.

Type locality, "in alta planitie Mexicana, inter Salamanca et Queretaro."



RANGE: Highlands of southern Mexico.

HERBARIUM SPECIMEN:

OAXACA: Sierra de San Felipe, cool pine woods, *Pringle* 4919.

8. *Trisetum filifolium* Scribn.; Beal, Grasses N. Amer. 2: 375. 1896.

Type locality, "Mexico (Chihuahua)," the type specimen collected in the Sierra Madre by *Pringle* (no. 1431).

RANGE: Known only from the mountains of Chihuahua.

HERBARIUM SPECIMENS:

CHIHUAHUA: Sánchez, rocky woods, *Hitchcock* 7682. Sierra Madre, cool slopes, *Pringle* 1430, 1431.

9. *Trisetum fournieranum* nom. nov.

*Trisetum gracile* Fourn. Mex. Pl. 2: 108. 1886, not Boiss. 1845.

Type locality, Mexico, "La Hoya," and "San Luis de Potosí," being cited.

RANGE: Highlands of central and southern Mexico.

HERBARIUM SPECIMENS:

HIDALGO: Pachuca, *Rose* 3587.

MÉXICO: Sierra de las Cruces, open fir woods, *Pringle* 6149. Popocatepetl, woods, *Hitchcock* 5996; mossy bank, *Hitchcock* 6003, 6005. Popo Park, mossy bank in woods, *Hitchcock* 5974.

10. *Trisetum virletii* Fourn. Mex. Pl. 2: 108. 1886.

Type locality, "San Luis de Potosí," the type specimen collected by *Virlet* (no. 1384).

RANGE: Highlands of central and southern Mexico.

HERBARIUM SPECIMENS:

MICHOACÁN: Pátzcuaro, cool slopes of mountains, *Pringle* 3979. Morelia, *Arsène* in 1909.

MÉXICO: Ixtaccihuatl, open woods, *Purpus* 1612; *Purpus* in 1903. Sierra de las Cruces, *Pringle* 7571.

VERACRUZ: Cumbre de Istepec, *Liebmann* 597.

MORELOS: Tres Marías Mountains, *Pringle* 11758.

77. *SPHENOPHOLIS* Scribn. Rhodora 8: 142. 1906.

1. *Sphenopholis obtusata* (Michx.) Scribn. Rhodora 8: 142. 1906.

*Aira obtusata* Michx. Fl. Bor. Amer. 1: 62. 1803.

Type locality, "in aridis, a Carolina ad Floridam."

RANGE: Northeastern United States to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Alamos, *Palmer* 577 in 1890.

CHIHUAHUA: Sánchez, rocky ravine, *Hitchcock* 7712.

DURANGO: Durango, edge of a garden, *Palmer* 255 in 1896.

COAHUILA: Río Grande Valley near Díaz, *Pringle* 8285.

NUEVO LEÓN: Monterey, along wet irrigation ditch, *Hitchcock* 5571.

FEDERAL DISTRICT: Pasture, *Hitchcock* 5893.

PUEBLA: Puebla, *Nicolas* in 1910.

OAXACA: Along ditch between Tule and Oaxaca, *Hitchcock* 6166.

78. *KOELERIA* Pers. Syn. Pl. 1: 97. 1805.

1. *Koeleria cristata* (L.) Pers. Syn. Pl. 1: 97. 1805.

*Aira cristata* L. Sp. Pl. 63. 1753.

Type locality, Europe, "in Angliae, Galliae, Helvetiae siccioribus."

RANGE: Cooler parts of the northern hemisphere.



## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Colonia García, *Nelson* 6198.DURANGO: Otinapa, *Palmer* 343 in 1906. Guanaceví, *Nelson* 4735 (this specimen appears to be *K. cristata longifolia* Vasey).FEDERAL DISTRICT: Above Santa Fé, *Pringle* 9608.WITHOUT LOCALITY: *Liebmann* 609.79. *AVENA* L. Sp. Pl. 79. 1753

## KEY TO THE SPECIES.

- Lemmas glabrous or nearly so..... 2. *A. sativa*.  
 Lemmas pubescent with long brown hairs.  
   Teeth of lemmas acute, not awned..... 1. *A. fatua*.  
   Teeth of lemmas awned; pedicels subcapillary..... 3. *A. barbata*.

1. *Avena fatua* L. Sp. Pl. 80. 1753.

WILD OAT.

Type locality, "in Europae agris inter segetes."

RANGE: Weed throughout North America, especially on the Pacific slope, introduced from Europe.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, along railway, *Hitchcock* 7699.COAHUILA: Saltillo, waste places and cultivated fields, *Palmer* 8 in 1898.SAN LUIS POTOSÍ: San Luis Potosí, edge of field, *Hitchcock* 5694.QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5859.MÉXICO: Toluca, rocky hill, *Hitchcock* 6891.PUEBLA: Tehuacán, *Hitchcock* 6053.OAXACA: Las Sedas, *Conzatti & González* 263.2. *Avena sativa* L. Sp. Pl. 79. 1753.

OAT.

Type locality unknown, the species named from cultivated plants.

RANGE: Commonly cultivated and occasionally escaped.

## HERBARIUM SPECIMEN FROM MEXICO:

FEDERAL DISTRICT: Volunteer along trolley, *Hitchcock* 5887.3. *Avena barbata* Brot. Pl. Lusit. 1: 108. 1804.

Type locality, Portugal.

RANGE: Pacific coast of United States and Lower California.

## HERBARIUM SPECIMEN FROM MEXICO:

LOWER CALIFORNIA: Guadalupe Island, *Palmer* 668 in 1889.80. *TRISTACHYA* Nees, Agrost. Bras. 458. 1829.

## KEY TO THE SPECIES.

- Panicle branches shorter than the spikelets, rarely slightly longer, appressed, the spikelets 3 cm. long; terminal portion of awn 3 to 6 cm. long, flexuous..... 1. *T. avenacea*.  
 Panicle branches, at least the lowermost, much longer than the spikelets, these, excluding the awns, not over 2 cm. long; terminal portion of the awn 0.5 to 1.5 cm. long, straight.  
 Plants robust, 1.5 meters or more high; blades 5 to 10 mm. wide; panicle branches capillary, elongated and lax.... 3. *T. laxa*.  
 Plants slender, about 1 meter high; blades 3 to 4 mm. wide; panicle branches slender but not capillary, ascending.. 2. *T. angustifolia*.

1. *Tristachya avenacea* (Presl) Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 23. 1901.*Monopogon avenaceus* Presl, Rel. Haenk. 1: 325. pl. 44. 1830.

Type locality, "Mexico."



RANGE: Pacific slope of southern Mexico.

HERBARIUM SPECIMENS:

JALISCO: Guadalajara, dry granitic hills, *Pringle* 4479; hillside, *Pringle* 11759.

Río Blanco, *Palmer* 304 in 1886.

OAXACA: Villa Alta, *Liebmann* 671.

2. *Tristachya angustifolia* sp. nov.

Perennial; culms loosely cespitose, thickened at base, slender, glabrous, about 1 meter high; sheaths glabrous; ligule a dense ring of short hairs; blades narrow, glabrous beneath, scabrous above and on the margins, flat, the tip involute and indurated, the lower elongated, 3 to 4 mm. wide, the upper reduced to involute points; panicle long-exserted, 10 to 15 cm. long, consisting of a few slender branches, the lower as much as 6 cm. long, these simple or bearing 1 or 2 ascending branchlets; axis and branches glabrous, scabrous toward the apex; spikelets, excluding the awns, about 2 cm. long, tawny rather than purple, as in *T. laxa*, the pedicels longer than the spikelets; glumes glabrous or scabrous on the nerves above; fertile lemma about 8 mm. long, strongly appressed-villous on the callus, less so toward the apex and more or less glabrate in the middle region, ending in two short-acuminate teeth about 1 mm. long; awn flat, stout, once geniculate, the lower portion loosely but firmly twisted, brown, scabrous-pubescent, nearly 2 cm. long, the upper portion straight, purplish, 12 to 15 mm. long.

Type in the U. S. National Herbarium, no. 301143, collected near Santa Teresa, top of Sierra Madre, Tepic, Mexico, August 13, 1897, by Dr. J. N. Rose (no. 2229).

This species differs from *T. laxa* in the lower and more slender stems, narrow blades, smaller panicle with shorter and ascending branches, the distribution of the pubescence on the lemma, and the short-acuminate teeth. In *T. laxa* the lemma is long-villous all over, the hairs on the callus being shorter, and the teeth of the lemma longer and awn-pointed.

RANGE: Known only from the type collection.

3. *Tristachya laxa* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 24. f. 7. 1901.

Type locality, "State of Durango," the type specimen collected in the southernmost tip of the State, by Rose (no. 2334).

RANGE: Known only from the type collection.

81. *DANTHONIA* DC. Fl. Franç. 3: 32. 1805.

1. *Danthonia mexicana* Scribn. Proc. Acad. Phila. 1891: 301. pl. 13. f. 7, 7b. 1892.

Type locality, "dry limestone ledges, Carneros Pass," Coahuila, the type specimen collected by *Pringle* (no. 3279).

RANGE: Highlands of central and southern Mexico.

HERBARIUM SPECIMENS:

COAHUILA: Carneros Pass, limestone ledges, *Pringle* 3279.

PUEBLA: Tehuacán, limestone hills, *Pringle* 9551, 6767.

82. *MICROCHLOA* R. Br. Prodr. Fl. Nov. Holl. 208. 1810.

1. *Microchloa indica* (L. f.) Kuntze, Rev. Gen. Pl. 3<sup>2</sup>: 356. 1898.

*Nardus indicus* L. f. Suppl. Pl. 105. 1781.

Type locality, "Tanquebaria," India.

RANGE: Warmer parts of both hemispheres.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de San Francisquito, *Brandeggee* in 1899. El Taste, *Brandeggee* in 1893. La Chuparosa, *Brandeggee* in 1893.

CHIHUAHUA: Chihuahua, dry gravelly soil, hills and plains, *Pringle* 425.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

DURANGO: Durango, slopes of hills, *Palmer* 532 in 1896; rocky hill, Iron Mountain, *Hitchcock* 7633.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7471.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 136, *Parry & Palmer* 970 in 1878.

JALISCO: Guadalajara, *Palmer* 616 in 1886; prairie, near San Pedro, *Hitchcock* 7304. San Nicolás, sterile clay hill, *Hitchcock* 7206. Zapotlán, rocky hill, *Hitchcock* 7258.

QUERÉTARO: Querétaro, rocky hill, *Hitchcock* 5857.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6723. Telles, *Orcutt* 4135.

MICHOACÁN: Uruápan, open stony place, *Hitchcock* 6966.

MÉXICO: Popo Park, open place in pine woods, *Hitchcock* 5963; open ground, *Hitchcock* 6021. Toluca, open rocky place, *Hitchcock* 6908. Federal District, open grassy pasture, *Hitchcock* 5890; along railway, *Hitchcock* 5908; lava fields, *Pringle* 9570; *Harshberger* 204; *Bourgeau* 446; *Orcutt* 3592.

PUEBLA: Tehuacán, flat place on cactus hill, *Hitchcock* 6081. Santa Bárbara, *Nicolas* in 1910.

VERACRUZ: Consoquitla, *Liebmann* 553. Mirador, *Liebmann* 552.

MORELOS: Cuernavaca, rocky barren, *Hitchcock* 6843.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6114.

83. *CAPRIOLA* Adans. Fam. Pl. 2: 31, 532. 1763.1. *Capriola dactylon* (L.) Kuntze, Rev. Gen. Pl. 2: 764. 1891. BERMUDA GRASS.

*Panicum dactylon* L. Sp. Pl. 58. 1753.

*Cynodon dactylon* Pers. Syn. Pl. 1: 85. 1805.

Type locality, "in Europa australi."

RANGE: Warmer parts of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Alamos, arroyo, *Rose, Standley & Russell*, 13011. Hermosillo, by ditch in meadow, *Hitchcock* 3581; *Rose, Standley & Russell* 12405; rocky border of Sonora River, *Chase* 5501.

SINALOA: Culiacán, *Rose, Standley & Russell* 14971. Mazatlán, thickets, *Rose, Standley & Russell* 14076. Fuerte, sandy soil along river, *Rose, Standley & Russell* 13444. Topolobampo, *Rose, Standley & Russell* 13281.

DURANGO: Torreón, along ditch, *Hitchcock* 7553.

COAHUILA: Saltillo, cultivated grounds, *Palmer* 254 in 1898. Parras, *Purpus* 5087.

TAMAULIPAS: Tampico, *Palmer* 152 in 1910. La Barra, 8 kilometers east of Tampico, *Palmer* 290 in 1910.

JALISCO: Guadalajara, open mesa, road to Barranca de Oblatos, *Hitchcock* 7312.

GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6943. Irapuato, along railway, *Hitchcock* 7434.

MICHOACÁN: Morelia, *Arsène* in 1909.

FEDERAL DISTRICT: Along track, *Hitchcock* 5926.

PUEBLA: Fort de Guadalupe, *Nicolas* in 1909.

VERACRUZ: Tlacotalpán, *Nelson* 520.

OAXACA: Tomellín, along railway, *Hitchcock* 6237.

84. *SPARTINA* Schreb. in Gmel. Syst. Nat. 1: 123. 1791.1. *Spartina spartinae* (Trin.) Merr. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 9: 11. 1902.

*Vilfa spartinae* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3<sup>1</sup>: 82. 1840.

*Spartina junciformis* Engelm. & Gray, Bost. Journ. Nat. Hist. 5: 238. 1845.

Type locality, "Texas," the type specimen communicated by Hooker.

RANGE: In the region of the Gulf from Florida to central Mexico.



## HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Tampico, brackish marsh, *Hitchcock* 5782.SAN LUIS POTOSÍ: Hacienda de Angostura, alkaline meadows, *Pringle* 3760.**85. CAMPULOSUS** Desv. *Nouv. Bull. Soc. Philom. Paris* 2: 189. 1810.

## KEY TO THE SPECIES.

- Spike 1..... 1. *C. planifolius*.  
 Spikes 2 or 3..... 2. *C. plumosus*.

**1. Campulosus planifolius** Presl, *Rel. Haenk.* 1: 287. 1830.

Type locality, "Mexico."

RANGE: Known only from the type collection and the following.

## HERBARIUM SPECIMEN:

OAXACA: Niltepec to Zanatepec, *Nelson* 2841.**2. Campulosus plumosus** sp. nov.

Perennial; culm cespitose, erect, scabrous or minutely pubescent, especially below the nodes and the inflorescence, about 70 or 80 cm. high; sheaths scabrous or the lower smooth, those of the culm much shorter than the internodes; ligule 1 mm. or less long; blades firm, strongly nerved, soon involute, 10 to 25 cm. long, 1 to 2 mm. wide, scabrous, gradually narrowed into an involute setaceous point; inflorescence long-exserted, consisting of 2 or 3 digitate, flexuous spikes, 4 to 10 cm. long, the rachis about 1 mm. wide, velvety-pubescent, naked at the very base; spikelets closely imbricated, those at the base and tip reduced; glumes unequal, the first 2 mm. long, 1-nerved, scarious, lanceolate, acute, glabrous, glandular along the lower part of the keel, the second glume 5 mm. long, 3-nerved, brown-mottled, gradually narrowed to an acute scarious apex, the nerves bearing a row of bead-like yellow glands along the lower half or two-thirds, the midnerve bristly-pubescent below the awn, the awn attached about the middle, stiffly perpendicular, 2 to 3 mm. long, turgid at base; first lemma hyaline 2.5 mm. long, containing no flower or palea, 3-nerved, densely long-ciliate on the lateral nerves nearly to the apex, the hairs 1 mm. long, the awn attached about the middle, erect, slender, 4 mm. long, the callus pilose; second lemma hyaline, 3 mm. long, ciliate like the first, but the hairs longer, the apex 2-toothed, the awn from between the teeth and about 1 mm. below the apex, erect, slender, about 1 cm. long, the callus pilose, the palea delicate, narrow, less than half as long as the lemma; third lemma fertile, 3 mm. long, broad, hyaline, 3-nerved, the lateral pair of nerves marginal and densely long-ciliate on the upper half (the hairs 2 mm. long), short-ciliate on the lower half, the awn from the obscurely toothed apex, 3 mm. long, erect, the palea about as long as the lemma, slightly 2-toothed, the keels scabrous; fourth lemma on a stipe about 1 mm. long, sterile, 2 mm. long, glabrous and awnless, containing a narrow palea about as long as the lemma; fifth floret reduced to a rudiment raised on a slender stipe, the whole not exceeding the fourth floret.

Type in the U. S. National Herbarium, no. 555998, collected at Cerro Colorado, vicinity of Culiacán, Sinaloa, Mexico, November 5, 1904, by T. S. Brandege.

Known only from the type collection.

**86. CHLORIS** Swartz, *Prodr. Veg. Ind. Occ.* 25. 1788.

## KEY TO THE SPECIES.

Lemma awnless (EUSTACHYS).

Floret dark brown, second glume short-awned from a broad

2-lobed apex..... 1. *C. petraea*.

Floret green or purplish; second glume oblong, awnless,

acute..... 2. *C. submutica*.



**Lemma awned.**

Rudimentary floret inconspicuous, narrow, not broadened at apex.

Blades elongated, acuminate; spikes numerous, 10 to 15 cm. long, scattered toward the summit of the culm; plant bearing cleistogamous underground spikelets..... 10. *C. clandestina*.

Blades mostly less than 10 cm. long; spikes several, more or less approximate, mostly not over 5 cm. long; no underground spikelets.

Awn of lemma about 3 mm. long; rudiment about half as long as lemma..... 9. *C. tenuispica*.

Awn of lemma 8 to 10 mm. long; rudiment very narrow, 0.5 mm. long, inclosed by the in-rolled lemma..... 8. *C. radiata*.

Rudimentary floret evident, truncate, broadened at summit.

Awn shorter than the lemma; rudiment triangular-truncate.

Lemma long-pilose on the keel and marginal nerves except at the base..... 4. *C. ciliata*.

Lemma slightly ciliate, but not pilose; rudiment hood-shaped..... 3. *C. cucullata*.

Awn more than twice as long as the lemma.

Rudiment triangular-truncate, 2-awned..... 5. *C. paraguayensis*.

Rudiment cuneate, twice as long as broad, 1-awned.

Lemma conspicuously pilose on the margin above, the hairs 2 mm. long..... 6. *C. elegans*.

Lemma short-ciliate on the margins above, the hairs less than 1 mm. long..... 7. *C. virgata*.

**1. *Chloris petraea* Swartz, Prodr. Veg. Ind. Occ. 25. 1788.**

Type locality, "Jamaica."

RANGE: Southern United States and West Indies to Costa Rica.

**HERBARIUM SPECIMENS FROM MEXICO:**

TAMAULIPAS: La Barra, *Palmer* 285 in 1910. Tampico, among brush in low land, *Hitchcock* 5798.

**2. *Chloris submutica* H. B. K. Nov. Gen. & Sp. 1: 167. pl. 50. 1816.**

Type locality, "in temperatis convallis Mexicanæ propter littora Tezcucensis" [Lake Texcoco].

RANGE: Highlands of Mexico.

**HERBARIUM SPECIMENS:**

CHIHUAHUA: Valley near Chihuahua, *Pringle* 424. Miñaca, along railway, *Hitchcock* 7731.

DURANGO: Durango, in stiff, black, waxy loam, *Palmer* 181 in 1896; dry ground, *Hitchcock* 7594. Otinapa, *Palmer* 341 in 1906. Tepehuanes, *Palmer* 362 in 1906.

COAHUILA: Saltillo, near ditches in cornfields, *Palmer* 390 in 1898; *Hitchcock* 5588.

TEPICO: Sierra Madre near Santa Teresa, *Rose* 2143.

ZACATECAS: Zacatecas, gulch in dry sterile hills, *Hitchcock* 7502.

AGUASCALIENTES: Aguascalientes, edge of field, *Hitchcock* 7453.

SAN LUIS POTOSÍ: San Luis Potosí, edge of field, *Hitchcock* 5686; *Schaffner* 130.

JALISCO: Guadalajara, *Palmer* 242 in 1886; open mesa, road to Barranca de Oblatos, *Hitchcock* 7313; fields, *Pringle* 11221. Zapotlán, railway right of way, *Hitchcock* 7129. Orozco, alkaline soil, near large pond, *Hitchcock* 7380.



## HERBARIUM SPECIMENS—Continued.

GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6934. Irapuato, moist, sandy-clay plain, *Hitchcock* 7411.

QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5818.

HIDALGO: Ixmiquilpan, river banks, *Rose, Painter & Rose* 9058. Pachuca, along road, *Hitchcock* 6748.

MÉXICO: Valley of Mexico, *Pringle* 9569, *Schumann* 1711. Tlalnepantla, *Rose, Painter & Rose* 8386. Toluca, rocky hill, *Hitchcock* 6906. Federal District, *Bourgeau* 494, *Holway* 13; along trolley, *Hitchcock* 5878; *Orcutt* 3690.

PUEBLA: Esperanza, along railway, *Hitchcock* 6468; roadsides, *Purpus* 2896. San Marcos, along railway embankment, *Hitchcock* 6505. Tehuacán, along railway, *Hitchcock* 6056. Chalchicomula, along railway, *Hitchcock* 6305. Along the Atoyac, *Nicolas* in 1910.

3. *Chloris cucullata* Bisch. Ann. Sci. Nat. III. Bot. 19: 357. 1853.

Type locality, "Mexico boreali \* \* \* Tamaulipas prope Matimoros."

RANGE: Southwestern United States and northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5524; along ditch, *Hitchcock* 5578.

TAMAULIPAS: Victoria, *Palmer* 398 in 1907.

4. *Chloris ciliata* Swartz, Prodr. Veg. Ind. Occ. 25. 1788.

Type locality, "Jamaica."

RANGE: Texas to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5530, 5550.

TAMAULIPAS: Victoria, *Palmer* 550 in 1907. Tampico, along street, *Hitchcock* 5790.

SAN LUIS POTOSÍ: Cárdenas, along railway, *Hitchcock* 5734.

OAXACA: Tomellín, along railway track, *Hitchcock* 6220.

5. *Chloris paraguayensis* Steud. Syn. Pl. Glum. 1: 204. 1854.

Type locality, "Paraguay."

RANGE: Northern Mexico and the West Indies to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Tampico, *Palmer* 148 in 1910; common weed along railway, *Hitchcock* 5784.

6. *Chloris elegans* H. B. K. Nov. Gen. & Sp. 1: 166. pl. 49. 1816.

Type locality, "inter Mexico et Queretaro."

RANGE: Southwestern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandegge* 39 in 1899, *Purpus* 315. Near Los Angeles Bay, *Palmer* 506 in 1887.

SONORA: Llano, along track, *Hitchcock* 3525. Hermosillo, along ditch, *Hitchcock* 3538; meadow near river, *Hitchcock* 3592; rocky cliff, *Hitchcock* 3605; sandy bed of river, *Hitchcock* 3619. Imeris to Santa Ana via Magdalena, *Griffiths* 6835. Loquka Ranch to Altar, *Griffiths* 6900. Nogales, along railway, *Hitchcock* 3636.

CHIHUAHUA: Valley near Chihuahua, *Pringle* 474. Southwestern Chihuahua, *Palmer* 118 in 1885. Santa Eulalia Plains, *Wilkinson* in 1885. Sánchez, along railway, *Hitchcock* 7688. Between Casas Grandes and Sabinal, *Nelson* 6354.

SINALOA: Topolobampo, open bottom land, among cactus, *Palmer* 245 in 1897.

DURANGO: Durango, along road, *Hitchcock* 7582; in shade, moist bottoms and along ditches, *Palmer* 176 in 1896; abundant on hillsides and plains, *Palmer* 765 in 1896. Tlahualilo, barren hills, *Pittier* 477. Torreón, weed in field, *Hitchcock* 7564; rocky hill, *Hitchcock* 7545.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

- COAHUILA: Jaral, *Schumann* 1716. Saltillo, along irrigation ditch, *Hitchcock* 5586.  
 TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14248.  
 ZACATECAS: Zacatecas, gulch in dry sterile hills, *Hitchcock* 7506.  
 AGUASCALIENTES: Aguascalientes, edge of field, *Hitchcock* 7452.  
 SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 131; *Parry & Palmer* 961 in 1878; irrigation ditch, *Hitchcock* 5691. Cárdenas, *Holway* 3146.  
 JALISCO: Río Blanco, *Palmer* 199 in 1886. Zapotlán, railway right of way, *Hitchcock* 7123. San Nicolás, prairie, *Hitchcock* 7187. Guadalajara, on roof of hotel, *Hitchcock* 7261. Colotlán, *Rose* 3604.  
 GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6932. Irapuato, moist sandy-clay plain, *Hitchcock* 7395.  
 QUERÉTARO: Querétaro, rocky hill, *Hitchcock* 5844.  
 COLIMA: Colima, *Palmer* 140 in 1897. Alzada, open hills, *Hitchcock* 7054.  
 MICHOACÁN: Morelia, east of Zapote, *Arsène* in 1909.  
 FEDERAL DISTRICT: Bourgeau 911, *Orcutt* 3693.  
 PUEBLA: Tlacuiloltepec, *Purpus* 4078. Tehuacán, limestone hills near El Riego, *Rose, Painter & Rose* 9906; Seler 6; bottom-land field, *Hitchcock* 6073.  
 MORELOS: Cuernavaca, weed in pasture, *Hitchcock* 6835. Santa Fé, *Orcutt* 4438, 4374.  
 GUERRERO: Canyon de la Mano Negra, near Iguala, *Rose, Painter & Rose* 9385. Balsas, along railway, *Hitchcock* 6801.  
 OAXACA: Oaxaca, *Conzatti* 321; along hedge, *Hitchcock* 6107. Tomellín, along ditch, *Hitchcock* 6246; *Rose, Painter & Rose* 10081.  
 YUCATÁN: Sacalum, *Schott* 632.

7. *Chloris virgata* Swartz, Fl. Ind. Occ. 1: 203. 1797.

Type locality, "Antigua."

RANGE: Northern Mexico and West Indies to Costa Rica.

## HERBARIUM SPECIMENS FROM MEXICO:

- DURANGO: Torreón, along ditch, *Hitchcock* 7549. Durango, along ditch, *Hitchcock* 7657.  
 COAHUILA: Saltillo, along wet ditch, *Hitchcock* 5620.  
 NUEVO LEÓN: Monterey, along irrigation ditch, *Hitchcock* 5574.  
 AGUASCALIENTES: Aguascalientes, edge of field, *Hitchcock* 7454.  
 SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 133; field, *Hitchcock* 5656, 5698; *Griffiths* 6533; Park Alameda, *Hitchcock* 5703. Cárdenas, irrigation ditch, *Hitchcock* 5749. Guascama, *Purpus* 5431.  
 JALISCO: Zapotlán, railway right of way, *Hitchcock* 7138. Guadalajara, prairie near San Pedro, *Hitchcock* 7282. San Nicolás, prairie, *Hitchcock* 7193.  
 GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6927. Irapuato, moist sandy-clay plain, *Hitchcock* 7412.  
 QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5804.  
 MICHOACÁN: Uruápan, along road, *Hitchcock* 6965.  
 FEDERAL DISTRICT: *Seaton* 2.  
 PUEBLA: Atlixco, *Nelson* in 1893. Tehuacán, old field, *Hitchcock* 6033; *Liebmann* 239. Rancho Tosados, *Nicolas* in 1909.  
 VERACRUZ: Jalapa, along railway near Coatepec, *Hitchcock* 6662. Orizaba, roadside ditch, *Hitchcock* 6336.  
 MORELOS: Cuernavaca, pasture, *Hitchcock* 6855; along track, *Hitchcock* 6875.  
 GUERRERO: Santa Fé, along railway, *Hitchcock* 6688.  
 OAXACA: Oaxaca, along road, *Hitchcock* 6110; open ground along railway, *Hitchcock* 6129; along ditch between Tule and Oaxaca, *Hitchcock* 6170.



**8. *Chloris radiata* (L.) Swartz, Prodr. Veg. Ind. Occ. 26. 1788.***Agrostis radiata* L. Syst. Nat. ed. 10. 873. 1759.

Type locality, Jamaica.

RANGE: West Indies and southern Mexico to Panama.

HERBARIUM SPECIMENS FROM MEXICO:

COLIMA: Colima, *Palmer* 1253 in 1891.VERACRUZ: Sanborn, *Orcutt* 3242.**9. *Chloris tenuispica* Nash, Bull. Torrey Club 25: 436. 1898.**

Type locality, "Texas," the type specimen collected by Nealley.

RANGE: Texas and northern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Monterey, along irrigation ditch, *Hitchcock* 5568.TAMAULIPAS: Tampico, along street, *Hitchcock* 5788.**10. *Chloris clandestina* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 25. 1901.***Gymnopogon longifolius* Fourn. Mex. Pl. 2: 144. 1886.*Chloris longifolia* Vasey, Contr. U. S. Nat. Herb. 1: 284. 1893, not Steud. 1854.

Type locality, "Vera Cruz," the type specimen collected by Gouin (no. 52).

RANGE: Sonora to Oaxaca.

HERBARIUM SPECIMENS:

SONORA: Hermosillo, in meadow along river, *Hitchcock* 3572.SINALOA: Culiacán, in good soil on wooded plains, *Palmer* 1763 in 1891. Topolobampo, bottom lands, *Palmer* 238 in 1897. Imala, *Palmer* 1763 in 1891.NUEVO LEÓN: Monterey, edge of field, *Hitchcock* 5559.SAN LUIS POTOSÍ: Las Canóas, along railway, *Hitchcock* 5766.JALISCO: Guadalajara, side of Barranca de Oblatos, *Hitchcock* 7355.GUANAJUATO: Irapuato, dry shrubby hill, *Hitchcock* 7431.MORELOS: Yautepec, *Pringle* in 1902.OAXACA: Tomellín, along ditch, *Hitchcock* 6226.**87. *TRICHLORIS* Fourn. in Benth. Journ. Linn. Soc. Bot. 19: 102. 1881.**

Kuntze,<sup>1</sup> regarding *Trichloris* as untenable because of *Trichlora* Baker 1877, publishes for this genus the name *Chloropsis* Hack. (mentioned as a synonym and without description by Hackel<sup>2</sup>). Both of the former names appear, however, to be valid, since they are differently derived.

## KEY TO THE SPECIES.

- Spikelets 2-flowered, both lemmas with 3 long awns..... 1. *T. mendocina*.  
 Spikelets 3 to 5 flowered, the lateral awns of the lemmas more or less  
 reduced, sometimes wanting..... 2. *T. pluriflora*.

**1. *Trichloris mendocina* (Phil.) Kurtz, Mem. Fac. Cienc. Exact. Univ. Córdoba 1897: 37. 1897.***Chloris ? mendocina* Phil. Anal. Univ. Chile 36: 208. 1870.

Type locality, "Mendoza."

RANGE: Southwestern United States to Chile.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Valley near Chihuahua, *Pringle* 475.DURANGO: Torreón, along dry ditch, mostly among shrubs and cactus, *Hitchcock* 7724.<sup>1</sup> Rev. Gen. Pl. 2: 771. 1891.<sup>2</sup> In Engl. & Prantl, Pflanzenfam. 2<sup>2</sup>: 59. 1887.



**2. *Trichloris pluriflora*** Fourn. Mex. Pl. 2: 142. 1886.

Type locality, "Texas, inter Laredo et Bejar," the only locality cited.

RANGE: Texas and New Mexico to Argentina.

HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Sabinas, *Nelson* 6827.OAXACA: Tomellín, rocky soil near river, *Hitchcock* 6202. Río de Santa Lucía, boundary of Oaxaca and Puebla, rocks, arroyos, *Purpus* 2895.**88. *BOUTELOUA*** Lag. Var. Cienc. 24: 134. 1805.

GRAMA GRASS.

## KEY TO THE SPECIES.

Plants annual.

Spike 1..... 2. *B. procumbens*.

Spikes 2 or more.

Spikelets pectinately arranged.

Awns scarcely exceeding the spikelets..... 3. *B. barbata*.Awns exceeding the spikelets 1 mm. or more..... 4. *B. arenosa*.

Spikelets not pectinately arranged.

Leaves tuberculate-pubescent; spikes subtriangular  
in outline..... 5. *B. alamosana*.Leaves not tuberculate-pubescent; spikes nearly  
linear..... 1. *B. aristidoides*.

Plants perennial.

Spike normally 1, conspicuously scorpioid.

Plants stoloniferous..... 7. *B. stolonifera*.Plants not stoloniferous..... 8. *B. scorpioides*.

Spikes normally 2 or more.

Plants stoloniferous; culms white-lanate..... 6. *B. eriopoda*.Plants sometimes decumbent but not stoloniferous;  
culms not lanate.

Spikelets pectinately arranged.

Spikes normally 2.

Glumes tuberculate; rachis prolonged  
beyond the spikelets as a naked  
point.Internodes hirsute-villous..... 10. *B. hirticulmis*.Internodes glabrous..... 9. *B. hirsuta*.Glumes not tuberculate; rachis not pro-  
longed.Culms erect, simple, annual..... 12. *B. gracilis*.Culms geniculate, branching, partially  
perennial..... 13. *B. ramosa*.

Spikes normally 4 or more.

Second glume long-pilose; spikes flexuous. 11. *B. parryi*.

Second glume glabrous or scabrous only.

Culms decumbent, rooting at the lower  
nodes..... 14. *B. sonorae*.

Culms erect or ascending.

Awns twice as long as the body of  
the lemma, much exceed-  
ing the spikelet..... 17. *B. trifida*.



- Awns much shorter than the body  
of the lemma, but slightly  
exceeding the spikelet.
- Base of plant strong, woody,  
rhizomatous; fertile  
floret glabrous at base.. 16. *B. karwinskii*.
- Base of plant not woody nor  
rhizomatous; fertile  
floret pilose at base.... 15. *B. roihrockii*.
- Spikelets not pectinately arranged.
- Spikes many, usually 30 or more.
- Awns longer than the body of the spikelet;  
plants usually straggling.
- Spikes with a single spikelet; fertile  
lemma entire..... 21. *B. juncea*.
- Spikes normally with 5 or more spike-  
lets; fertile lemma 3-toothed... 22. *B. disticha*.
- Awns much shorter than the body of the  
spikelet.
- Sheaths densely hairy; lower spikes  
compound..... 20. *B. pringlei*.
- Sheaths glabrous.
- Second glume about as long as the  
fertile floret..... 19. *B. curtispindula*.
- Second glume about half as long  
as the fertile floret..... 18. *B. acuminata*.
- Spikes rarely as many as 20, usually fewer  
than 15.
- Glumes densely pubescent.
- Spikes 4 to 6, rhomboid in outline;  
sterile floret 1, deeply trifid, the  
middle awn flattened..... 24. *B. chondrosioides*.
- Spikes 10 to 20, triangular in outline;  
sterile florets 2, awned, the  
awns similar..... 25. *B. eludens*.
- Glumes glabrous or minutely pubescent on  
the nerves only.
- Spikelets few, crowded, the first floret  
fertile..... 23. *B. texana*.
- Spikelets numerous, not crowded, the  
first floret mostly staminate, the  
second fertile.
- Plants smooth, grayish; culms  
geniculate..... 28. *B. repens*.
- Plants more or less prominently  
papillose-pubescent.
- Base of plants hard, rhizo-  
matous; culms simple;  
spikes 2 to 3 cm. long.. 27. *B. radicata*.
- Base of plants not rhizo-  
matous; culms branch-  
ing; spikes usually  
about 15 mm., some-  
times 20 mm. long.... 26. *B. filiformis*.



1. ***Bouteloua aristidoides*** (H. B. K.) Griseb. Fl. Brit. W. Ind. 537. 1864.

*Dinebra aristidoides* H. B. K. Nov. Gen. & Sp. 1: 171. 1816.

Type locality, "in asperis frigidis convallis Tolucensis \* \* \* (Regno Mexicano)."

RANGE: Southwestern United States to South America.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Calmallí, on dry plain, *Orcutt* in 1899. Carmen Island, *Palmer* 859 in 1890. San José del Cabo, *Brandeggee* 4 and 16 in 1890. Los Angeles Bay, *Palmer* 507 in 1887.

SONORA: Alamos, *Palmer* 697 in 1890. Yaqui River, *Palmer* 7 in 1869. Guaymas, rocky lava hill, *Hitchcock* 3549; *Palmer* 162 in 1887. Nogales, along railway, *Hitchcock* 3638. Hermosillo, along railway, *Hitchcock* 3533; meadow near river, *Hitchcock* 3594. Llano, along railway, *Hitchcock* 3519, 3527.

CHIHUAHUA: Chihuahua, dry bed of river, *Hitchcock* 7803; hills and plains, *Pringle* 477. Santa Eulalia Plains, *Wilkinson* in 1885. Southwestern Chihuahua, *Palmer* 51 in 1885. Casas Grandes, *Nelson* 6329.

SINALOA: Topolobampo, *Palmer* 237 in 1897. Culiacán, *Brandeggee* in 1904; stony hillsides, *Palmer* 1547 in 1891. Lodiago, river bottoms, often overflowed during rainy season, *Palmer* 1650 in 1891.

COAHUILA: Monclova, *Palmer* 1353 in 1880. Soledad, low mountains with few oaks, 25 miles southwest from Monclova, *Palmer* 1354 in 1880.

DURANGO: Tlahualilo, barren hills, *Pittier* 474. Durango, rocky hill, Iron Mountain, *Hitchcock* 7627, *Griffiths* 9862; hillsides, *Palmer* 714a and 717 in 1896. Torreón, base of rocky hill, *Hitchcock* 7550.

ZACATECAS: San Juan Capistrano, on the road to Huejuquilla, *Rose* 2490.

AGUASCALIENTES: Aguascalientes, edge of field, *Hitchcock* 7444.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 941 in 1878, *Schaffner* 155.

JALISCO: Tequila, dry bluffs, *Pringle* 4592.

QUERÉTARO: Querétaro, rocky hill, *Hitchcock* 5828.

COLIMA: Manzanillo, along street, *Hitchcock* 7037; Armería, sandy soil, *Hitchcock* 7021.

OAXACA: Tomellín, along railway, *Hitchcock* 6240.

2. ***Bouteloua procumbens*** (Durand) Griffiths, Contr. U. S. Nat. Herb. 14: 364. 1912.

*Chloris procumbens* Durand, Chlor. Sp. 16. 1808.

Type locality unknown.

RANGE: Colorado and Utah to South America.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 3 in 1885. Guerrero, plains, *Pringle* 1434. Sánchez, along railway, *Hitchcock* 7697.

DURANGO: Durango, rocky hill, Iron Mountain, *Hitchcock* 7626; abundant on mesquite plains, *Palmer* 712 in 1896.

COAHUILA: Saltillo, moist places on mesas, *Palmer* 397 and 398 in 1898. Chojo Grande, 27 miles southeast of Saltillo, *Palmer* 332 in 1904.

● ZACATECAS: Zacatecas, dry sterile hill, *Hitchcock* 7519; *Griffiths* 8139.

AGUASCALIENTES: Aguascalientes, weed, edge of field, *Hitchcock* 7445.

SAN LUIS POTOSÍ: San Luis Potosí, irrigation ditch, *Hitchcock* 5692; edge of field, *Hitchcock* 5707; *Schaffner* 156. Alvarez, *Palmer* 176 in 1902.

JALISCO: Guadalajara, *Palmer* 480 in 1886.

QUERÉTARO: Querétaro, rocky field, *Hitchcock* 5845; agave field, *Hitchcock* 5862.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6710, 6711; sandy river bed, *Hitchcock* 6764; *Orcutt* 3903. Telles, *Orcutt* 4153. Zontecomate Station, dry mesas, *Pringle* 13242.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6896. Federal District, *Orcutt* 3608; Valley of Mexico, *Rose & Hay* 5972; open ground, *Hitchcock* 5905, 5943; *Pringle* 6450, 11218.

PUEBLA: San Marcos, along railway embankment, *Hitchcock* 6506. Chalchicomula, along dike in field, *Hitchcock* 6288; along railway, *Hitchcock* 6307.

3. *Bouteloua barbata* Lag. Var. Cienc. 2<sup>4</sup>: 141. 1805.

Type locality, Mexico.

RANGE: Utah to California and south in the highlands to Oaxaca.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: La Paz, *Palmer* 126 in 1890. Los Angeles Bay, Gulf of California, *Palmer* 508 in 1887. Cape St. Lucas, *Xantus* 117. Carmen Island, *Palmer* 854 and 857 in 1890. Arroyo Salado (Cape Region), *Purpus* 410. San José del Cabo, *Brandege* 11 and 31 in 1890, *Brandege* in 1902.

SONORA: Guaymas, *Palmer* 508 in 1887. Papago Tanks, *MacDougal* in 1907. Northwestern Sonora, hills, *Pringle* in 1884. Imuris to Altar, *Griffiths* 6861. Altar, *Griffiths* 6890, 6905.

CHIHUAHUA: Chihuahua, mesa, *Hitchcock* 7782; hills and plains, *Pringle* 490. Presidio del Norte, *Parry* in 1852.

DURANGO: Torreón, rocky hill, *Hitchcock* 7538. Durango, open gravelly place, base of hill, *Hitchcock* 7620; *Griffiths* 9861; hillsides, *Palmer* 714 in 1896. Tlahualilo, barren hills, *Pittier* 470.

COAHUILA: Jimulco, plains, *Pringle* 11216; valley of Jimulco, *Pringle* 13626. Saltillo, low places in mesas, *Palmer* 400 and 401 in 1898, 1356 in 1880.

AGUASCALIENTES: Aguascalientes, rocky sterile hill, *Hitchcock* 7469.

SAN LUIS POTOSÍ: San Luis Potosí, dry ditch, *Hitchcock* 5660; *Parry & Palmer* 946 in 1878; *Schaffner* 181, 183, 185.

QUERÉTARO: Querétaro, alfalfa field, *Hitchcock* 5809.

HIDALGO: Dublán, *Griffiths* 8116.

FEDERAL DISTRICT: *Bourgeau* 667.

PUEBLA: Tehuacán, open dry ground, *Hitchcock* 6077.

OAXACA: San Antonio Valley, *Smith* 957. Oaxaca, along track near Ignacio Mejía, *Hitchcock* 6116. Tomellín, rocky hill, *Hitchcock* 6235; *Rose, Painter & Rose* 10078.

4. *Bouteloua arenosa* Vasey, U. S. Dept. Agr. Div. Bot. Bull. 12<sup>1</sup>: pl. 34. 1890.

Type locality, "Guaymas on the Gulf of California."

RANGE: Southwestern United States and northwestern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Without locality, *Orcutt* in 1889.

SONORA: Guaymas, *Palmer* 189 in 1887. Hermosillo, dry soil, *Hitchcock* 3534.

5. *Bouteloua alamosana* Vasey, Contr. U. S. Nat. Herb. 1: 115. 1891.

Type locality, "Alamos."

RANGE: Sonora and the Pacific slope of Central America.

## HERBARIUM SPECIMEN FROM MEXICO:

SONORA: Alamos, *Palmer* 698 in 1890.

6. *Bouteloua eriopoda* (Torr.) Torr. U. S. Rep. Expl. Miss. Pacif. 4: 155. 1856.

*Chondrosium eriopodum* Torr. in Emory, Mil. Recon. 154. 1848.

Type locality, "New Mexico."

RANGE: Texas to Arizona and Chihuahua.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, rocky hill, *Hitchcock* 7794; dry gravelly soil, hills and plains, *Pringle* 411. Santa Eulalia Plains, *Wilkinson* 348.



**7. *Bouteloua stolonifera*** Scribn. Proc. Acad. Phila. 1891: 302. 1892.

Type locality, "Plains, State of Zacatecas, between San Luis Potosí and Aguascalientes," the type specimen collected by Pringle (no. 3174).

RANGE: Highlands of central Mexico.

## HERBARIUM SPECIMENS:

ZACATECAS: La Honda Station, plains, *Pringle* 3174. Cedros, making turf in plains, *Lloyd* 104.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 172. Alonzo, *Griffiths* 8054.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6734.

MÉXICO: Metepec, dry mesas, *Pringle* 13241.

**8. *Bouteloua scorpioides*** Lag. Gen. & Sp. Nov. 5. 1816.

Type locality, "N. Hisp." [Mexico].

RANGE: Highlands from Chihuahua to Orizaba.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Encinillas, *Griffiths* 8527.

ZACATECAS: Cedros, making turf in low places of plain, *Lloyd* 105.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 168.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6721.

MÉXICO: Campero, *Griffiths* 8460, 8461, 8462. Federal District, *Orcutt* 4107, *Pringle* 8820.

PUEBLA: Esperanza, barren hills, *Pittier* 422; rocky hill, *Hitchcock* 6477. Chalcicomula, *Hitchcock* 6272.

**9. *Bouteloua hirsuta*** Lag. Var. Cienc. 2<sup>4</sup>: 141. 1805.

Type locality, Mexico.

RANGE: From Illinois and South Dakota to the Rocky Mountains and southward to southern Mexico; also in Florida.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Cape Region Mountains, *Brandegge* in 1899. Sierra de la Laguna, *Brandegge* in 1890.

SONORA: Near Cocospora Ranch, *Griffiths* 6792.

CHIHUAHUA: Chihuahua, hills and plains, *Pringle* 409; rocky hill, *Hitchcock* 7795.

Santa Eulalia Mountains, *Wilkinson* 347. Between Colonia García and Pratt's ranch below Pacheco, *Nelson* 6246.

DURANGO: Durango, dry ground, *Hitchcock* 7604; stony hillsides, *Palmer* 870 in 1896.

COAHUILA: Saltillo, in low places on mesas, *Palmer* 405 in 1898, 1357 in 1880.

TEPIC: Between Concepción and Acaponeta, *Rose* 1904. Near Acaponeta, *Rose* 3293.

ZACATECAS: Zacatecas, gulch in dry sterile hills, *Hitchcock* 7501.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 186, *Parry & Palmer* 943 in 1878. Las Canoas, prairie, *Hitchcock* 5753.

JALISCO: Road between Huejuquilla and Mezquitic, *Rose* 2588. Zapotlán, railway right of way, *Hitchcock* 7113.

HIDALGO: Sierra de Pachuca, *Rose, Painter & Rose* 8752. Tula, hills, *Pringle* 11215.

FEDERAL DISTRICT: *Schaffner* in 1875; *Rose, Painter & Rose* 9497.

MORELOS: Cuernavaca, *Rose & Rose* 11055.

OAXACA: San Pablo Huitzo, *Conzatti* 2013.

**10. *Bouteloua hirticulmis*** Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 4. 1901.

Type locality, "Sierra de San Francisquito Mountains, Lower California."

RANGE: Pacific slope, Lower California to Chiapas.



## HERBARIUM SPECIMENS:

LOWER CALIFORNIA: San Francisquito Mountains, *Brandeggee* 30 in 1890, *Brandeggee* in 1899. El Taste, *Brandeggee* in 1902.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7464; *Griffiths* 9849.

JALISCO: Río Blanco, *Palmer* 201 in 1886. Guadalajara, prairie near San Pedro, *Hitchcock* 7273. San Nicolás, sterile clay hill, *Hitchcock* 7214. El Llego, *Griffiths* in 1909.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6135. Valley of Oaxaca, *Nelson* 1259.

CHIAPAS: Roadside between Tuxtla and San Cristóbal, *Nelson* 3121.

11. *Bouteloua parryi* (Fourn.) Griffiths, Contr. U. S. Nat. Herb. 14: 381. 1912.

*Chondrosium parryi* Fourn. Mex. Pl. 2: 150. 1886.

Type locality, "Circa San Luis de Potosí."

RANGE: Southwestern United States to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Santa Eulalia Mountains, *Wilkinson* in 1885. Chihuahua, sandy alluvium of streams, rocky hills, *Pringle* 413.

DURANGO: Durango, cornfield, *Hitchcock* 7610.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 943½, *Schaffner* 187.

12. *Bouteloua gracilis* (H. B. K.) Lag.; Steud. Nom. Bot. ed. 2. 1: 219. 1840.

*Chondrosium gracile* H. B. K. Nov. Gen. & Sp. 1: 176. pl. 58. 1816.

Type locality, "La Buffa de Guanajuato Mexicanorum."

RANGE: Manitoba to Montana and California and southward to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: San José Mountains, *Mearns* 1658.

CHIHUAHUA: Miñaca, mesa, *Hitchcock* 7746. Chihuahua, mesa, *Hitchcock* 7799; hills and plains, *Pringle* 407. Sánchez, flat, gravelly bottom of ravine, *Hitchcock* 7716. Casas Grandes, *Nelson* 6330. Southwestern Chihuahua, *Palmer* 24 in 1885. Near Colonia García in the Sierra Madre, *Townsend & Barber* 257. Santa Eulalia Plains, *Wilkinson* in 1885.

DURANGO: Durango, dry ground, *Hitchcock* 7574; hillsides and plains, *Palmer* 545 in 1896.

COAHUILA: Saltillo, low places on mesas, *Palmer* 399 and 403 in 1898; on hillsides among rocks in small tufts, *Palmer* 406 in 1898. Jaral, *Schumann* 1723.

ZACATECAS: Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7499. Pico de Teira, *Lloyd* 242.

AGUASCALIENTES: Aguascalientes, *Rose & Painter* 7729; sterile rocky hill, *Hitchcock* 7460.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 944 in 1878; edge of field, *Hitchcock* 5675. San Rafael, *Schaffner* 157.

GUANAJUATO: Guanajuato, *Dugès* in 1897.

QUERÉTARO: San Juan del Río, stony hillside, *Rose, Painter & Rose* 9569.

HIDALGO: Between Pachuca and Real del Monte, *Rose & Painter* 6710. Dublán, *Griffiths* 9809. Pachuca, rocky hill, *Hitchcock* 6704, 6722.

MÉXICO: Toluca, prairie, *Hitchcock* 6917. Federal District, *Bourgeau* 448; along railway, *Hitchcock* 5906; *Orcutt* 3641.

PUEBLA: San Marcos, railway embankment, *Hitchcock* 6510. Esperanza, dry open ground, *Hitchcock* 6465; rocky hill, *Hitchcock* 6483. Chalchicomula, rocky hill, *Hitchcock* 6271. Hacienda Noria, *Nicolas* in 1908.

13. *Bouteloua ramosa* Scribn.; Vasey, U. S. Dept. Agr. Div. Bot. Bull. 12<sup>1</sup>: pl. 44. 1890.

Type locality, southwestern Texas.

RANGE: Texas to central Mexico.



## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Santa Eulalia Mountains, *Wilkinson* 346 in 1885; dry calcareous banks, *Pringle* 414.

COAHUILA: Saltillo, among rocks on hillsides, *Palmer* 404 in 1898. Monclova, *Palmer* 1358 in 1880.

ZACATECAS: Mountains back of Apizalaya, Hacienda de Cedros, *Lloyd* 254.

14. *Bouteloua sonora* Griffiths, Contr. U. S. Nat. Herb. 14: 389. f. 43. 1912.

Type locality, "Yaqui River," Sonora, the type collected by Palmer in 1869.

RANGE: Northwestern Mexico.

## HERBARIUM SPECIMENS:

SONORA: Yaqui River, *Palmer* in 1869. Alamos, *Palmer* 751 in 1890. Guaymas, stony flat between hill and bay, *Chase* 5509; *Hitchcock* 3552.

SINALOA: Mountains at headwaters of Mazatlán River, *Wright* 1322. Imala, *Palmer* 1761 in 1891.

15. *Bouteloua rothrockii* Vasey, Contr. U. S. Nat. Herb. 1: 268. 1893.

Type locality, "Cottonwood, Arizona."

RANGE: Utah to Sinaloa.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Near Cocospora Ranch, *Griffiths* 6796. Hermosillo, meadow, *Hitchcock* 3583; dry soil, *Hitchcock* 3536. Llano, along railway, *Hitchcock* 3523. Agiabampo, *Palmer* 791 in 1890. Guaymas, *Palmer* 166 and 204 in 1887.

SINALOA: Culiacán, *Brandegge* 11 in 1904; in large patches in the ravines, *Palmer* 1543 in 1891. Topolobampo, in open bottom lands, *Palmer* 244 and 235 in 1897.

16. *Bouteloua karwinskii* (Fourn.) Griffiths, Contr. U. S. Nat. Herb. 14: 394. 1912.

*Chondrosium karwinskii* Fourn. Mex. Pl. 2: 137. 1886.

Type locality, "Cañon de las Minas et Victoria."

RANGE: Central Mexico.

## HERBARIUM SPECIMENS:

ZACATECAS: Hacienda de Cedros, *Lloyd* 183. Zacatecas, low grassy land, *Lloyd* 170.

17. *Bouteloua trifida* Thurb. in S. Wats. Proc. Amer. Acad. 18: 177. 1883.

*Bouteloua trinii* (Fourn.) Griffiths, Contr. U. S. Nat. Herb. 14: 387. 1912. (The author takes 1881 as the date of publication of Fournier's work. See footnote, page 181).

Type locality, "Monclova, Coahuila."

RANGE: Southwestern United States to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Santa Eulalia Plains, *Wilkinson* in 1885. Chihuahua, dry gravelly soil, hills and plains, *Pringle* 412.

COAHUILA: Saltillo, hillsides, *Palmer* 402 in 1898, 522 in 1905; dry mesa *Hitchcock* 5639, 5648; mountains, *Palmer* 1355 in 1880.

NUEVO LEÓN: Monterey, agave field, *Hitchcock* 5531; along railway, *Hitchcock* 5532; dry hills and mesas, *Pringle* 1974, 11735.

TAMAULIPAS: Victoria, *Palmer* 370 and 552 in 1907.

SAN LUIS POTOSÍ: Minas de San Rafael, *Purpus* 5008. San Luis Potosí, *Parry & Palmer* 945 in 1878.

18. *Bouteloua acuminata* (Fourn.) Griffiths, Contr. U. S. Nat. Herb. 14: 406. 1912.

*Atheropogon acuminatus* Fourn. Mex. Pl. 2: 139. 1886.

Type locality, "Mirador" and "Potrero de Consoquitla" cited.

RANGE: Central Mexico.

## HERBARIUM SPECIMEN:

SINALOA: Lodiogo, in large bunches on mountain sides, *Palmer* 1655 in 1891.



**19. *Bouteloua curtipendula* (Michx.) Torr. in Emory, Mil. Recon. 154. 1848.***Chloris curtipendula* Michx. Fl. Bor. Amer. 1: 59. 1803.

Type locality, "in aridis regionis Illinoensis ad Wabast."

RANGE: Northern United States to Argentina.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Carmen Island, *Palmer* 861 in 1890. Topo Mountains, *Orcutt* 671. San José del Cabo, *Brandeggee* in 1890 and in 1902.SONORA: San José Mountains, *Mearns* 1039. Guadalupe Canyon, *Merton* 2047.Hermosillo, rocky cliff, *Hitchcock* 3609. Nogales, along railway, *Hitchcock* 3633.CHIHUAHUA: Between Colonia García and Pratt's ranch below Pacheco, *Nelson* 6247. Chihuahua, *Palmer* 114 in 1908; rocky hill, *Hitchcock* 7797; hills and plains, *Pringle* 408. Southwestern Chihuahua, *Palmer* 206 in 1885. Santa Eulalia Plains, *Wilkinson* in 1885. Miñaca, rocky run, *Hitchcock* 7739.DURANGO: Durango, dry ground, *Hitchcock* 7606; by ditch, *Palmer* 194 in 1896. Torreón, rocky hill, *Hitchcock* 7539.COAHUILA: Chojo Grande, 27 miles southeast of Saltillo, *Palmer* 371 in 1904. Saltillo, large bunches about an old brick yard, *Palmer* 407 in 1898; sandy field, river bottom, *Hitchcock* 5614. Jaral, *Schumann* 1721.NUEVO LEÓN: Monterey, rocks among shrubs, *Hitchcock* 5518.ZACATECAS: Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7520. Hacienda de Cedros, foothills, *Lloyd* 201, 213. Pico de Teira, *Lloyd* 239. Concepción del Oro, *Palmer* 264 in 1904.AGUASCALIENTES: Aguascalientes, sterile, rocky hill, *Hitchcock* 7457.SAN LUIS POTOSÍ: Cárdenas, prairie near ditch, *Hitchcock* 5738. San Luis Potosí, edge of field, *Hitchcock* 5673; *Schaffner* 188.JALISCO: San Nicolás, sterile clay hill, *Hitchcock* 7213. Bolaños, *Rose* 2929. Río Blanco, *Palmer* 503 in 1886. Guadalajara, dry open ground, along rim of Barranca de Oblatos, *Hitchcock* 7328, 7345.GUANAJUATO: Irapuato, dry, shrubby hill, *Hitchcock* 7425.QUERÉTARO: Querétaro, agave field, *Hitchcock* 5860. San Juan del Río, stony hillside, *Rose, Painter & Rose* 9551.HIDALGO: Ixmiquilpan, limestone hillside, *Rose, Painter & Rose* 8977, 9027. Tula, along railroad, *Rose, Painter & Rose* 8359. Pachuca, rocky hill, *Hitchcock* 6706.MICHOACÁN: El Ocote, Cerro Pedregosa, *Langlassé* 537. Morelia, *Arsène* 2993.FEDERAL DISTRICT: *Orcutt* 3666; lava rock, *Hitchcock* 5953, 5957; *Holway* 10; *Bourgeau* 491; agave field; *Hitchcock* 5904.PUEBLA: Mount Orizaba, *Seaton* 113. Tehuacán, limestone hills; El Riego, *Rose, Painter & Rose* 9989; cactus hill, *Hitchcock* 6083, 6087; *Liebmann* 580. San Luis Tultitlanapa, *Purpus* 3595. Esperanza, barren hills, *Pittier* 444; *Hitchcock* 6474. San Marcos, railway embankment, *Hitchcock* 6538. Hills road to Mexico City, *Nicolas* in 1909.VERACRUZ: Orizaba, *Botteri* 699; open rocky hill, *Hitchcock* 6357.MORELOS: Cuernavaca, rocky place, *Hitchcock* 6862.GUERRERO: Balsas, rocky hill, *Hitchcock* 6772; along railway cut, *Hitchcock* 6807.OAXACA: Monte Albán near Oaxaca City, *Smith* 958. Oaxaca, rocky hill, *Hitchcock* 6148. Tomellín, rocky hill, *Hitchcock* 6200. Cuicatlán, *Nelson* 1700.**20. *Bouteloua pringlei* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 4. 1901.**

Type locality, "Mountains of Iguala, Mexico."

RANGE: Highlands, southern Mexico.

## HERBARIUM SPECIMENS:

MORELOS: Hills near Yautepec, *Pringle* 11217.GUERRERO: Iguala, limestone ledges of mountains, *Pringle* 8374.



**21. *Bouteloua juncea* (Desv.).**

*Triathera juncea* Desv.; Beauv. Ess. Agrost. 40. pl. 9. f. 4. 1812.

*Triaena racemosa* H. B. K. Nov. Gen. & Sp. 1: 179. pl. 61. 1816, not *Bouteloua racemosa* Lag. 1805.

*Eutriana triaena* Trin. Gram. Unifl. 239. 1824.

*Bouteloua triaena* Scribn. Proc. Acad. Phila. 1891: 307. 1892.

*Triaena juncea* Griffiths, Contr. U. S. Nat. Herb. 14: 354. 1912.

Type locality unknown.

RANGE: Central and southern Mexico.

## HERBARIUM SPECIMENS:

COAHUILA: Saltillo, *Griffiths* 8408.

HIDALGO: Dublán, *Griffiths* 8117, 8122. El Salto, calcareous soil, *Pringle* 9573.

PUEBLA: Tehuacán, hills east of city, *Rose, Painter & Rose* 10117; *Hitchcock* 6074; *Ross* 1302a. Chalchicomula, rocky hill, *Hitchcock* 6302.

MORELOS: Jojutla, limestone hills, *Pringle* 8708.

OAXACA: Valley of Oaxaca, *Nelson* 1542. Dominguillo, *Nelson* 1842. Las Sedas, dry calcareous hills, *Pringle* 4782; *Conzatti & González* 265. Oaxaca, rocky hill, *Hitchcock* 6146.

YUCATÁN: Nohcacab, *Schott* 740.

**22. *Bouteloua disticha* (H. B. K.) Benth. Journ. Linn. Soc. Bot. 19: 105. 1881.**

*Polyodon distichum* H. B. K. Nov. Gen. & Sp. 1: 175. pl. 55. 1816.

Type locality, "In montosis, alsis Regni Quitensis."

RANGE: Yucatan to South America, also in Cuba.

## HERBARIUM SPECIMEN FROM MEXICO:

YUCATÁN: Nohcacab, *Schott* 741.

**23. *Bouteloua texana* S. Wats. Proc. Amer. Acad. 18: 196. 1883.**

Type locality, "Western Texas."

RANGE: Texas and adjacent Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

COAHUILA: Díaz, calcareous mesas, *Pringle* 9018.

**24. *Bouteloua chondrosioides* (H. B. K.) Benth. in S. Wats. Proc. Amer. Acad. 18: 179. 1883.**

*Dinebra chondrosioides* H. B. K. Nov. Gen. & Sp. 1: 173. pl. 53. 1816.

Type locality, "Prope urbem Valladolid de Mechoacan."

RANGE: Texas to Arizona and south to Oaxaca.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Near Cocospora Ranch, *Griffiths* 6790.

CHIHUAHUA: Chihuahua, rocky hills, *Pringle* 410. Santa Eulalia Plains, *Wilkinson* in 1885.

DURANGO: Durango, dry ground, *Hitchcock* 7601; common on hillsides and plains, *Palmer* 546 in 1896; *Griffiths* 9863.

ZACATECAS: Plateado, *Rose* 2782.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7467, 7476.

JALISCO: Huejuquilla, *Rose* 2532.

MICHOACÁN: San Antonio, *Griffiths* in 1909. Loma del Zapote near Morelia, *Arsène* in 1909. Morelia, *Arsène* in 1909.

PUEBLA: Zapotlán near Tehuacán, *Ross* 1304.

OAXACA: Oaxaca, *Conzatti* 156; rocky hill, *Hitchcock* 6103, 6150; *Griffiths* 9742.

**25. *Bouteloua eludens* Griffiths, Contr. U. S. Nat. Herb. 14: 401. pl. 78, 79, 80A. 1912.**

Type locality, "Southern exposures upon the northern slope of the Santa Rita Mountains, Arizona," the type specimen collected by Griffiths (no. 7269).



RANGE: Arizona and Sonora.

HERBARIUM SPECIMEN FROM MEXICO:

SONORA: Near Cocospora Ranch, south of Nogales, *Griffiths* 6789.

26. *Bouteloua filiformis* (Fourn.) Griffiths, Contr. U. S. Nat. Herb. 14: 413. 1912.  
*Atheropogon filiformis* Fourn. Mex. Pl. 2: 140. 1886.

Type locality, "Hacienda de la Naranja," Mexico.

RANGE: Texas to Arizona and south to Colombia.

HERBARIUM SPECIMENS FROM MEXICO:

DURANGO: Durango, dry ground, *Hitchcock* 7603.

NEUVO LEÓN: Monterey, rocky hill, Obispado, *Hitchcock* 5569; valley of Monterey, *Pringle* 2547.

TAMAULIPAS: Victoria, *Palmer* 482 in 1907.

AGUASCALIENTES: Aguascalientes, sterile rocky hill, *Hitchcock* 7462.

SAN LUIS POTOSÍ: San Luis Potosí, *Hitchcock* 5679. Cárdenas, railway cut, *Hitchcock* 5718. Minas de San Rafael, *Purpus* 5437.

JALISCO: Guadalajara, prairie near San Pedro, *Hitchcock* 7277. La Junta, along track, *Hitchcock* 7002. Zapotlán, railway right of way, *Hitchcock* 7118. San Nicolás, prairie, *Hitchcock* 7194; sterile clay hill, *Hitchcock* 7201.

GUANAJUATO: Irapuato, dry, shrubby hill, *Hitchcock* 7422, 7423.

QUERÉTARO: Querétaro, *Rose & Rose* 11140; rocky hill, *Hitchcock* 5827. Between San Juan del Río and Cadereyta, *Rose, Painter & Rose* 9678.

HIDALGO: Ixmiquilpan, limestone hillside, *Rose, Painter & Rose* 8960.

COLIMA: Colima, *Orcutt* 4568, *Palmer* 1254 in 1891. Alzada, gravelly prairie, *Hitchcock* 7084.

MICHOACÁN: Punguato near Morelia, *Arsène* 2850.

FEDERAL DISTRICT: Valley of Mexico, *Rose & Painter* 6538, 6821, 8018, *Rose, Painter & Rose* 8271. Near Chapultepec, *Hitchcock* 7841; lava rock, *Hitchcock* 5954.

PUEBLA: Atlixco, *Nelson* in 1893. Tehuacán, *Rose & Hay* 5820; flat place on cactus hill, *Hitchcock* 6082, 6088.

VERACRUZ: Coatzacoalcas, *Orcutt* 3255. Veracruz, sandy prairie, *Hitchcock* 6555. Orizaba, *Botteri* 1070. Consoquitla, *Liebmann* 585.

MORELOS: Cuernavaca, hillside pasture, *Hitchcock* 6820.

GUERRERO: Apipilulco, prairie, *Hitchcock* 6698. Acapulco, *Palmer* 113 in 1894.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6101, 6150½. Valley of Oaxaca, *Liebmann* 575.

27. *Bouteloua radicata* (Fourn.) Griffiths, Contr. U. S. Nat. Herb. 14: 411. 1912.  
*Atheropogon radicosus* Fourn. Mex. Pl. 2: 140. 1886.

Type locality, "In pascuis pr. Mejico."

RANGE: New Mexico to California and south to Oaxaca.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Cape Region, *Brandegge* 2 in 1899, 57 in 1893.

CHIHUAHUA: Between Colonia García and Pratt's ranch below Pacheco, *Nelson* 6258. Sierra Madre, *Nelson* 6305; near Colonia Garcia, *Townsend & Barber* 226. Southwestern Chihuahua, *Palmer*, 115a in 1885. Guerrero, ledges of river canyon, *Pringle* 1436.

DURANGO: Durango, common on hillsides and plains, *Palmer* 547 in 1896.

COAHUILA: Monclova, Caracol Mountains, *Palmer* 1354 in 1882.

JALISCO: On road between Monte Escobedo and Colotlán, *Rose* 2672. Guadalajara, prairie near San Pedro, *Hitchcock* 7270. Río Blanco, *Palmer* 188 and 301 in 1886.

HIDALGO: Dublán, *Griffiths* 8124.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

MICHOACÁN: Morelia, *Arsène* 2850.

FEDERAL DISTRICT: *Orcutt* 3675; hills, *Pringle* 8567; *Bourgeau* 450.

MORELOS: Cuernavaca, *Orcutt* 3885, *Rose, Painter & Rose* 10189.

GUERRERO: San Marcos, *Nelson* 2265. Balsas, rocky hill, *Hitchcock* 6780, 6788.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6136; Valley of Oaxaca, *Nelson* 1258, 1443.

28. *Bouteloua repens* (H. B. K.) Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 26. 1891.

*Dinebra repens* H. B. K. Nov. Gen. & Sp. 1: 172. pl. 52. 1816.

Type locality, "ad littora Oceani Pacifici prope Acapulco."

RANGE: Pacific coast of southern Mexico.

## HERBARIUM SPECIMENS:

COLIMA: Manzanillo, *Hitchcock* 7040, *Orcutt* 4459.

OAXACA: Salina Cruz, *Ross* 976.

89. *CATHESTECUM* Presl, Rel. Haenk. 1: 294. pl. 42. 1830.

## KEY TO THE SPECIES.

Plants annual..... 1. *C. prostratum*.

Plants perennial.

Plants cespitose; sterile lemmas 5 to 7-awned..... 4. *C. multifidum*.

Plants stoloniferous; sterile lemmas 3-awned (awns sometimes shorter than the lobes).

Sterile lemma cleft nearly to the base; sheaths glabrous. 3. *C. stoloniferum*.

Sterile lemma cleft less than halfway; sheaths more or less pubescent..... 2. *C. erectum*.

1. *Cathestecum prostratum* Presl, Rel. Haenk. 1: 295. pl. 42. 1830.

Type locality, "Mexico."

RANGE: Morelos, the only locality on record.

## HERBARIUM SPECIMEN:

MORELOS: Jojutla, limestone hills, *Pringle* 8707.

2. *Cathestecum erectum* Vasey & Hack. Bull. Torrey Club 11: 37. pl. 45. 1884.

Type locality, "Presidio, western Texas."

RANGE: Southwestern Texas and Sonora, south in the highlands to Oaxaca.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Plains near Altar, *Pringle* in 1884. Alamos, *Palmer* 705 in 1890. Hermosillo, dry soil, *Hitchcock* 3535; meadow near river, *Hitchcock* 3597. Guaymas, rocky lava hill, *Hitchcock* 3546, 3551; *Palmer* 161 and 345 in 1887. Yaqui River, *Palmer* 17 and 18 in 1869. Llano, along railway, *Hitchcock* 3528. Imuris to Santa Ana, *Griffiths* 6834.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 66 in 1885.

SINALOA: Culiacán, *Brandege* 1 and 2 in 1904. Imala, hillsides and arroyos, *Palmer* 1459 and 1460 in 1891.

JALISCO: Tequila, thin gravelly soil, *Pringle* 4559. Guadalajara, overhanging a bank, *Hitchcock* 7300, *Palmer* 270 in 1886. San Pedro, prairie, *Hitchcock* 7278. San Nicolás, sterile clay hill, *Hitchcock* 7200, 7202. Valencia, prairie, *Hitchcock* 7003. Road between Huejuquilla and Mezquitic, *Rose* 2582.

GUANAJUATO: Irapuato, rocky hill, *Hitchcock* 7436.

COLIMA: Colima, *Palmer* 12 in 1897, 1261 in 1891. Armería, prairie near railway, *Hitchcock* 7024.

PUEBLA: Tehuacán, *Rose & Hay* 5924. Santa Lucía, *Purpus* 3596.

GUERRERO: Apipilulco, prairie, *Hitchcock* 6697. Balsas, *Hitchcock* 6776; along railway, *Hitchcock* 6799, 6800.

OAXACA: Monte Albán, *Smith* 950. Oaxaca, rocky hill, *Hitchcock* 6120.



3. *Cathestecum stoloniferum* (Fourn.) Griffiths, Contr. U. S. Nat. Herb. 14: 362. 1912.

*Atheropogon stolonifer* Fourn. Mex. Pl. 2: 140. 1886.

Type locality, "La Parada, Sierra de Oajaca."

RANGE: Southern Mexico.

HERBARIUM SPECIMENS:

PUEBLA: Tehuacán, dry soil, *Hitchcock* 6072.

GUERRERO: Río Balsas, *Orcutt* 4166.

OAXACA: Tomellín, rocky hill, *Hitchcock* 6238; *Griffiths* 9764. San Antonio Valley, *Smith* 958.

4. *Cathestecum multifidum* Griffiths, Contr. U. S. Nat. Herb. 14: 360. f. 24. 1912.

Type locality, "Iguala, Mexico."

RANGE: Highlands of southern Mexico.

HERBARIUM SPECIMENS:

GUERRERO: Iguala, *Griffiths* in 1909.

OAXACA: Oaxaca, rocky hill, *Hitchcock* 6164.

90. **PENTARRHAPHIS** H. B. K. Nov. Gen. & Sp. 1: 177. pl. 60. 1816.

KEY TO THE SPECIES.

Spike consisting of 1 perfect spikelet and a rudimentary second

one..... 1. *P. scabra*.

Spike consisting of 2 perfect spikelets..... 2. *P. polymorpha*.

1. *Pentarrhaphis scabra* H. B. K. Nov. Gen. & Sp. 1: 178. pl. 60. 1816.

Type locality, "in planitie montana Mexicana prope Tula et Queretaro."

RANGE: Southern Mexico to Colombia.

HERBARIUM SPECIMEN FROM MEXICO:

CHIAPAS: Valley of Jiquipilas, *Nelson* 2940.

2. *Pentarrhaphis polymorpha* (Fourn.) Griffiths, Contr. U. S. Nat. Herb. 14: 357. 1912.

*Atheropogon polymorphus* Fourn. Mex. Pl. 2: 141. 1886.

Type locality, "San Luis de Potosi."

RANGE: Mexican plateau.

HERBARIUM SPECIMENS:

SINALOA: On road between Acaponeta and Rosario, *Rose* in 1897. Between Rosario and Colomas, *Rose* 1621.

DURANGO: Durango, *Palmer* 382 in 1896.

JALISCO: Tequila, *Rose & Hough* 4775. Guadalajara, hills, *Pringle* 5398; plains, *Pringle* 2559, 11242. Río Blanco, *Palmer* 200 in 1886.

MICHOACÁN: Morelia, *Arsène* in 1909.

MORELOS: Jojutla, limestone hills, *Pringle* 8707.

91. **TRIOGON** Roem. & Schult. Syst. Veg. 2: 34, 600. 1817.

1. *Triogon spicatus* (Nees) Ekman, Arkiv Bot. 11<sup>4</sup>: 36. 1912.

*Bromus spicatus* Nees, Agrost. Bras. 471. 1829.

*Leptochloa spicata* Scribn. Proc. Acad. Phila. 1891: 304. 1892.

Type locality, "in campis campo mimoso dictis, provinciae Piauhiauae."

RANGE: Texas to Argentina.

HERBARIUM SPECIMENS FROM MEXICO:

DURANGO: Durango, clefts of boulder, Iron Mountain, *Hitchcock* 7632.

SAN LUIS POTOSÍ: San Luis Potosí, gravelly mesas, *Pringle* 3267.

92. **ELEUSINE** Gaertn. Fruct. & Sem. 1: 7. pl. 1. 1788.

1. *Eleusine indica* (L.) Gaertn. Fruct. & Sem. 1: 8. 1788.

*Cynosurus indicus* L. Sp. Pl. 72. 1753.

Type locality, "in Indiis."



**RANGE:** Warmer regions of both hemispheres.

**HERBARIUM SPECIMENS FROM MEXICO:**

LOWER CALIFORNIA: San José del Cabo, *Brandeggee* 6 in 1890.

SONORA: Alamos, in orchard, *Rose, Standley & Russell* 13021. Guaymas, *Palmer* 35 and 45 in 1887.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 40 in 1885.

SINALOA: Fuerte, sandy soil, *Rose, Standley & Russell* 13580. Culiacán, moist field, *Rose, Standley & Russell* 14957. Mazatlán, waste ground, *Rose, Standley & Russell* 14139. Headwaters of Mazatlán river, *Wright* 1328.

DURANGO: Durango, along street, *Hitchcock* 7646.

TAMAULIPAS: Victoria, *Palmer* 464 in 1907.

TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14247. María Madre Island, *Nelson* 4305.

SAN LUIS POTOSÍ: Las Canóas, along railway, *Hitchcock* 5757.

JALISCO: Guadalajara, *Palmer* 255 and 478 in 1886; along ditch, road to Barranca de Oblatos, *Hitchcock* 7322. San Nicolás, weed in field, *Hitchcock* 7231.

COLIMA: Colima, in garden, *Palmer* 21 in 1897, 1263 in 1891. Paso del Río, *Emrick* 5. Jala, along railway, *Hitchcock* 7013. Alzada, along railway, *Hitchcock* 7071.

MICHOACÁN: Morelia, *Arsène* in 1909.

FEDERAL DISTRICT: *Bourgeau* 1030; by ditch, *Hitchcock* 5948.

PUEBLA: Tehuacán, weed in field, *Hitchcock* 6065; banks of Atoyac, *Nicolas* in 1909. Mount Orizaba, *Seaton* 50.

VERACRUZ: Córdoba, *Fink* 4; weed, *Hitchcock* 6404. Coatzacoalcos, *Smith* 1050. Orizaba, *Botteri* 713; *Bourgeau* 2634; weed in street, *Hitchcock* 6310. Veracruz, weed, *Hitchcock* 6570. Antigua, *Liebmann* 230.

GUERRERO: Acapulco, *Palmer* 120 in 1894. Balsas, weed in field, *Hitchcock* 6789.

OAXACA: North of Tuxtepec, *Nelson* 365. Tomellín, along ditch, *Hitchcock* 6234. Oaxaca, along street, *Hitchcock* 6163.

TABASCO: San Juan Bautista, *Rovirosa* 14.

YUCATÁN: Mérida, *Schott* 738.

### 93. *DACTYLOCTENIUM* Willd. Enum. Pl. 1029. 1809.

#### 1. *Dactyloctenium aegyptium* (L.) Richt. Pl. Eur. 1: 68. 1891.

*Cynosurus aegyptius* L. Sp. Pl. 72. 1753.

Type locality given as "Africa, Asia, America."

**RANGE:** Tropical and subtropical regions of both hemispheres.

**HERBARIUM SPECIMENS FROM MEXICO:**

LOWER CALIFORNIA: Cape St. Lucas, *Xantus* 118. San José del Cabo, *Purpus* in 1901; *Brandeggee* 13 and 13½ in 1890.

SONORA: Guaymas, *Palmer* 328 in 1887; weed in park, *Hitchcock* 3568. Hermosillo, along ditch, *Hitchcock* 3532, 3579. Alamos, arroyo, *Rose, Standley & Russell* 12936. Yaqui River, *Palmer* 9 in 1869.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 73 in 1885.

SINALOA: Mazatlán, Observatory Hill, *Rose, Standley & Russell* 13679. Topolobampo, *Rose, Standley & Russell* 13268. Between Rosario and Acaponeta, *Rose* 1877.

DURANGO: Durango, rich, moist soil in cornfield, *Palmer* 735 in 1896; along road, *Hitchcock* 7579. Torreón, weed in field, *Hitchcock* 7555.

COAHUILA: Jaral, *Schumann* 1761.

TAMAULIPAS: La Barra, *Palmer* 258 and 590 in 1910.

TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14263. María Madre Island, *Nelson* 4256, 4295, *Maltby* 152. María Magdalena Island, *Nelson* 4317.

JALISCO: Guadalajara, *Palmer* 435 in 1886; prairie near San Pedro, *Hitchcock* 7291.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

COLIMA: Colima, in damp grassy bottoms and shady ravines, *Palmer* 10, 11, 167, and 168 in 1897; common along railway, *Hitchcock* 7018, 7051½.

MICHOACÁN: Prairie of Tibor, *Langlassé* 301.

VERACRUZ: Veracruz, *Müller* 2166; sandy prairie, *Hitchcock* 6564. Zacuapan, sulphur spring, *Purpus* 4431. Paso de Doña Juana, *Liebmann* 238. Coat-zacoalcos, *Smith* 1055.

MORELOS: Cuernavaca, weed in pasture, *Hitchcock* 6822.

GUERRERO: Balsas, along railway, *Hitchcock* 6797. Acapulco, *Palmer* 121 in 1894.

OAXACA: Cuicatlán, *Nelson* 1651a. Oaxaca, weed, *Hitchcock* 6117. Tomellín along ditch, *Hitchcock* 6233.

TABASCO: González River, *Rovirosa* 711.

YUCATÁN: Mérida, *Schott* 734.

94. **LEPTOCHLOA** Beauv. Ess. Agrost. 71. 1812.

## KEY TO THE SPECIES.

## Plants perennial.

Lemmas broad, notched at apex, the lateral nerves glabrous... 5. *L. dubia*.

Lemmas acute or awned, the lateral nerves pubescent.

Lemmas awnless or very short-awned; plant smooth and glaucous..... 2. *L. virgata*.

Lemmas awned, the awn as long as or longer than the body; sheaths and blades sparsely pilose, not glaucous... 3. *L. domingensis*.

## Plants annual.

Sheaths papillose-pilose; first floret not longer than the second glume; spikelets minute..... 1. *L. filiformis*.

Sheaths smooth or scabrous, not pilose.

Lemmas awned.

Panicle large, more than 10 cm. long, the longer branches usually as much as 10 cm. long; second glume 3 mm. long; lemmas not viscid... 8. *L. fascicularis*.

Panicle smaller, oval, usually less than 10 cm. long, the larger branches usually less than 5 cm. long; second glume 1.5 mm. long; lemmas viscid on the back..... 4. *L. viscida*.

Lemmas awnless or mucronate only.

Sheaths scabrous; florets closely imbricated, the lateral nerves of the lemmas not close to the margin..... 6. *L. floribunda*.

Sheaths smooth; florets loosely imbricated (not overlapping more than half their length), the lateral nerves marginal.

Spikelets about 4-flowered; lemmas acutish, the apex almost entire..... 7. *L. aquatica*.

Spikelets 6 to 8-flowered; lemmas erose or slightly 2-toothed at the broad apex, apiculate between the teeth..... 9. *L. imbricata*.

1. **Leptochloa filiformis** (Lam.) Beauv. Ess. Agrost. 71, 166. 1812.

*Festuca filiformis* Lam. Tabl. Encycl. 1: 191. 1791.

*Leptochloa mucronata* Kunth, Rév. Gram. 1: 91. 1833.

Type locality, "Amer[ica] Merid[ionalis]."

RANGE: Virginia to the Pacific Coast and south to the West Indies and South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Yaqui River, *Palmer* 8 in 1869. Alamos, *Palmer* 693 and 749 in 1890.

Llano, along railway, *Hitchcock* 3530. Hermosillo, meadow, *Hitchcock* 3585,



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

3591; rocky cliff, *Hitchcock* 3606; along railway and ditch, *Hitchcock* 3543. Guaymas, moist clay, rocky hill, *Hitchcock* 3550; rocky lava hill, *Hitchcock* 3559; open gravelly place, *Hitchcock* 3565; weed in park, *Hitchcock* 3569; *Palmer* 50 and 694 in 1887. Imeris to Santa Ana, *Griffiths* 6836, 6854. Loquka Ranch to Altar, *Griffiths* 6893, 6908. Papago Tanks, Pinacate Mountains, *MacDougal* 49.

CHIHUAHUA: Paso del Norte, *Pringle* 1161. Southwestern Chihuahua, *Palmer* 117 in 1885.

SINALOA: Headwaters of Mazatlán River, *Wright* 1316. Culiacán, in shade of bushes along river banks, *Palmer* 1551 and 1546 in 1891; *Brandeggee* in 1904. Rosario, *Rose* 1542. Topolobampo, *Palmer* 248 in 1897.

COAHUILA: Monclova, *Palmer* 1364 in 1880.

NUEVO LEÓN: Monterey, cornfield, *Hitchcock* 5554.

TAMAULIPAS: Victoria, *Palmer* 472 in 1907.

TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14249.

SAN LUIS POTOSÍ: Rascón, *Purpus* 5428.

JALISCO: Guadalajara, weed along trail down Barranca de Oblatos, *Hitchcock* 7356.

COLIMA: Colima, shady garden, *Palmer* 22 in 1897. Manzanillo, open place on wooded hill, *Hitchcock* 7039; *Orcutt* 4478. Jala, along railway, *Hitchcock* 7014.

PUEBLA: Hacienda Noria, *Nicolas* in 1910.

MORELOS: Santa Fé, *Orcutt* 4371.

GUERRERO: Balsas, gravel along railway, *Hitchcock* 6777; Río Balsas, *Orcutt* 4193. Canyon de la Mano Negra, near Iguala, *Rose, Painter & Rose* 9389. Las Amates, near railway, *Hitchcock* 6694.

OAXACA: Tomellín, rocky hill, *Hitchcock* 6207; weed in cornfield, *Hitchcock* 6244.

YUCATÁN: Mérida, *Schott* 590, 739.

2. *Leptochloa virgata* (L.) Beauv. Ess. Agrost. 166. 1812.

*Cynosurus virgatus* L. Syst. Nat. ed. 10. 876. 1759.

Type locality, Jamaica.

RANGE: West Indies and Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Tampico, *Palmer* 146 in 1910.

VERACRUZ: Córdoba, *Fink* in 1893. Sanborn, *Orcutt* 3240. Jicaltepec, *Liebmann* 252. Colipa, *Liebmann* 251.

OAXACA: San Gerónimo, *Nelson* 2768. Pluma, *Nelson* 2483.

3. *Leptochloa domingensis* (Jacq.) Trin. Fund. Agrost. 133. 1820.

*Cynosurus domingensis* Jacq. Misc. 2: 363. 1781.

Type locality not given, presumably Santo Domingo.

RANGE: Gulf Coast of the United States to eastern Mexico and the West Indies.

## HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Victoria, *Palmer* 394 in 1907.

TABASCO: San Juan Bautista, *Rovirosa* 691.

4. *Leptochloa viscida* (Scribn.) Beal, Grasses N. Amer. 2: 434. 1896.

*Diplachne viscida* Scribn. Bull. Torrey Club 10: 30. 1883.

Type locality, "Santa Cruz Valley, near Tucson, Arizona."

RANGE: New Mexico and Arizona to Sinaloa.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San Jorge, *Brandeggee* 5 in 1889.

SONORA: Alamos, *Palmer* 748 and 748½ in 1890. Guaymas, *Palmer* 692 in 1887.

Imeris to Santa Ana, *Griffiths* 6859. Guarorchi, along railway ditch, *Hitchcock* 3531. Hermosillo, sandy bed of run, *Hitchcock* 3612.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

CHIHUAHUA: Chihuahua, depression in mesa, *Hitchcock* 7781; wet places, plain, *Pringle* 814.

SINALOA: Culiacán, *Palmer* 1789 in 1891.

5. *Leptochloa dubia* (H. B. K.) Nees, Syll. Pl. Ratisb. 1: 4. 1824.

*Chloris dubia* H. B. K. Nov. Gen. & Sp. 1: 169. 1816.

Type locality, "in apricis subhumidis prope rupem porphyriticam el Peñon, in convalle Mexicana."

RANGE: Southern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Margarita Island, *Brandegge* 6 in 1889.

SONORA: Sonoyta, *Mearns* 2715. Guaymas, *Palmer* 270 and 273 in 1887. Nogales to Cocospora Ranch, *Griffiths* 6804.

CHIHUAHUA: Chihuahua, hills and plains, *Pringle* 422; along dry run, *Hitchcock* 7776.

SINALOA: Mazatlán, about salt marsh, *Rose, Standley & Russell* 14108.

DURANGO: Durango, along road, *Hitchcock* 7584; garden, *Palmer* 530 in 1896.

Santiago Papasquiaro, damp places, shady ravines, *Palmer* 468 in 1896.

COAHUILA: Jaral, *Schumann* 1720. Saltillo, fields, sandy river bottom, *Hitchcock* 5631; ditches and rich soil, *Palmer* 381 and 382 in 1898.

NUEVO LEÓN: Monterrey, rocks, *Hitchcock*, 5517.

ZACATECAS: Concepción del Oro, *Palmer* 268 in 1904. Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7523. Hacienda de Cedros, hills, *Lloyd* 231. Pico de Tevia, *Lloyd* 240.

AGUASCALIENTES: Aguascalientes, sterile, rocky hill, *Hitchcock* 7474; low ground along railway, *Hitchcock* 7483.

SAN LUIS POTOSÍ: Cárdenas, irrigation ditch, *Hitchcock* 5739. San Luis Potosí, alfalfa field, *Hitchcock* 5670; along dry ditch, *Hitchcock* 5653. Guascama, *Purpus* 5434.

JALISCO: Zapotlán, railway right of way, *Hitchcock* 7131.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7392.

QUERÉTARO: Querétaro, *Rose & Rose*, 11189, open, rocky hill, *Hitchcock* 5832½. San Juan del Río, stony hillside, *Rose, Painter & Rose*, 9587.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6715; *Orcutt* 3917. Tula, *Holway* 3230.

MÉXICO: Toluca, along ditch, *Hitchcock* 6912. Federal District, edge of field, *Hitchcock* 5892; bank along ditch, *Hitchcock* 5917; *Bourgeau* 533; *Orcutt* 3691.

PUEBLA: Tehuacán, *Rose & Hay* 5819; old field, *Hitchcock* 6034; along railway, *Hitchcock* 6048; calcareous soil, *Pringle* 9552. San Luis Tultitlanapa, *Purpus* 3591; banks of Atoyac, *Nicolas* in 1909.

MORELOS: Cuernavaca, along road, *Hitchcock* 6851.

OAXACA: Between Tule and Oaxaca, edge of field, *Hitchcock* 6172; along ditch, *Hitchcock* 6186.

WITHOUT LOCALITY: *Schaffner* 671.

6. *Leptochloa floribunda* Doell in Mart. Fl. Bras. 2<sup>3</sup>: 89. pl. 26. 1883.

Type locality, "ad ripas fluminis Amazonum inter Manaos et Santarem."

RANGE: Southern United States to Brazil.

## HERBARIUM SPECIMENS FROM MEXICO:

SINALOA: Culiacán, *Brandegge* 12 and 13 in 1904.

TEPIC: Foothills between Acaponeta and Pedro Paulo, *Rose* 1930.

TABASCO: Río del Carrizal, *Roviroso* 629.

7. *Leptochloa aquatica* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 26. 1901.

Type locality, "shallow water near Cuernavaca, State of Morelos," the type specimen collected by *Pringle* (no. 6664).



RANGE: Pacific slope of southern Mexico.

HERBARIUM SPECIMENS:

JALISCO: Valencia, along railway, *Hitchcock* 7004. Guadalajara, in water of ditch, road to Barranca de Oblatos, *Hitchcock* 7317.

MORELOS: Cuernavaca, shallow water, *Pringle* 6664; along ditch, in damp soil, bases creeping in water, *Hitchcock* 6859.

GUERRERO: Vista, along track, *Hitchcock* 6696.

8. *Leptochloa fascicularis* (Lam.) Gray, Man. 588. 1848.

*Festuca fascicularis* Lam. Tabl. Encycl. 1: 189. 1791.

Type locality, "Amer[ica] Merid[ionalis]."

RANGE: Northern United States to southern Mexico and in the West Indies.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Guaymas, *Palmer* 691 in 1887.

CHIHUAHUA: Chihuahua, in shallow water, *Pringle* 813.

DURANGO: Torreón, along ditch, *Hitchcock* 7729. Durango, in ditch, *Hitchcock* 7567; along water courses, *Palmer* 254 in 1896.

AGUASCALIENTES: Aguascalientes, edge of pond, *Hitchcock* 7494.

SAN LUIS POTOSÍ: San Luis Potosí, irrigation ditch, *Hitchcock* 5682; *Schaffner* 152.

JALISCO: Orozco, near large pond, *Hitchcock* 7377.

GUANAJUATO: Irapuato, moist, sandy-clay plain, *Hitchcock* 7389.

QUERÉTARO: Querétaro, in water of irrigation ditch, *Hitchcock* 5836.

MORELOS: Valley near Jojutla, *Pringle* 9595.

9. *Leptochloa imbricata* Thurb. in S. Wats. Bot. Calif. 2: 293. 1880.

Type locality, southern California, collections from "Larkins Station, San Diego County" and "Fort Yuma" cited.

RANGE: Texas to California and south to Argentina.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Calexico, along draw, *Chase* 5518. Maleje, Gulf of California, *Palmer* 47 in 1887. San José del Cabo, *Purpus* 312. Santa Agueda, *Palmer* 216 in 1890.

SONORA: Yaqui River, *Palmer* 5 in 1869. Sonoyta River, *Mearns* 2741. Guaymas, *Palmer* 47 in 1887. Hermosillo, by ditch in meadow, *Hitchcock* 3577.

SINALOA: Headwaters of Mazatlán River, *Wright* 1317a.

JALISCO: Guadalajara, *Palmer* 331 in 1886.

GUANAJUATO: Irapuato, low ground, *Hitchcock* 7432.

OAXACA: North of Tuxtepec, *Nelson* 367.

95. *GOUINIA* Fourn. Mex. Pl. 2: 103. 1886.

KEY TO THE SPECIES.

Spikelets awnless; perfect floret 1..... 1. *G. brandegei*.  
Spikelets awned; perfect florets 2 to several.

Awns longer than the lemmas; sheaths smooth or nearly so;  
lemmas pubescent at base, not long-pilose..... 4. *G. virgata*.

Awns shorter than the lemmas; sheaths scabrous; lemmas long-pilose on the nerves and marginal space except at summit.  
Spikelets (excluding the awns) 12 to 15 mm. long, the florets rather distant; panicle branches ascending..... 2. *G. mexicana*.

Spikelets (excluding the awns) 6 to 10 mm. long, the florets approximate; panicle branches divaricate..... 3. *G. latifolia*.



1. *Gouinia brandegei* (Vasey) Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 33: 21. 1903.

*Diplachne brandegei* Vasey, Proc. Calif. Acad. II. 2: 213. 1889.

Type locality, Lower California, the type collected on Magdalena Island by Brandegee in 1889 (no. 11).

RANGE: Known only from Lower California.

HERBARIUM SPECIMENS:

LOWER CALIFORNIA: Magdalena Island, *Brandegee* 7 and 11 in 1889. Carmen Island, *Palmer* 862 in 1890. San José del Cabo, *Brandegee* 38 in 1890. Purísima, *Brandegee* in 1889.

2. *Gouinia mexicana* (Scribn.) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 10. 1897.

*Leptochloa mexicana* Scribn. Proc. Acad. Phila. 1891: 302. 1892.

Type locality, "About dry ledges, Tamasopo Cañon," San Luis Potosí, the type specimen collected by Pringle (no. 3252).

RANGE: Known only from the type collection.

3. *Gouinia latifolia* (Griseb.) Vasey, Contr. U. S. Nat. Herb. 1: 365. 1895.

*Tricuspis latifolia* Griseb. Abh. Ges. Wiss. Göttingen 19: 211. 1874.

Type locality, "Cordoba \* \* \* in convallibus montibus pr. Ascochinga," Argentina.

RANGE: Yucatan to Argentina.

HERBARIUM SPECIMEN FROM MEXICO:

YUCATÁN: Nohcacab, *Schott* 703.

4. *Gouinia virgata* (Presl) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 10. 1897.

*Bromus virgatus* Presl, Rel. Haenk. 1: 263. 1830.

Type locality given as "in montanis Peruviae, in Mexico," the Peruvian reference probably erroneous, the species not being known from South America.

RANGE: Southern Mexico.

HERBARIUM SPECIMENS:

COLIMA: Alzada, shady ravine, *Hitchcock* 7086. Manzanillo, *Palmer* 1087 in 1890.

GUERRERO: Acapulco, *Palmer* 77 in 1894. Tlalixtaquilla, *Nelson* 2255.

OAXACA: San Agustín, *Liebmann* 505.

96. **BULBILIS** Raf. Amer. Month. Mag. 4: 190. 1819.

1. *Bulbilis dactyloides* (Nutt.) Raf.; Kuntze, Rev. Gen. Pl. 2: 763. 1891.

BUFFALO GRASS.

*Sesleria dactyloides* Nutt. Gen. Pl. 65. 1818.

Type locality, "open grassy plains of the Missouri."

RANGE: Saskatchewan to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Saltillo, along irrigation ditch, *Hitchcock* 5596; slope of mesas, *Palmer* 7 in 1898.

ZACATECAS: Zacatecas, gulch in dry, sterile hills, *Hitchcock* 7513. Hacienda de Cedros, sinks and flats, *Lloyd* 211. Concepción del Oro, *Palmer* 267 in 1904.

AGUASCALIENTES: Aguascalientes, *Hartweg* 250; sterile rocky hill, *Hitchcock* 7482.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 922 and 953 in 1878, *Schaffner* 127, 184; dry ground, *Hitchcock* 5663. Cárdenas, prairie, *Hitchcock* 5742. Alvarez, *Palmer* 167 in 1904.

GUANAJUATO: Irapuato, moist, sandy-clay plain, *Hitchcock* 7390.

QUERÉTARO: Querétaro, open, dry ground, common on hills, *Hitchcock* 5823.

HIDALGO: Telles, *Orcutt* 4148. Between Pachuca and Real del Monte, *Rose, Painter & Rose* 8684, *Rose & Painter* 6714; on mountain side, *Rose, Painter & Rose* 8733. Pachuca, rocky hill, *Hitchcock* 6718; along railway, *Hitchcock* 6754.

FEDERAL DISTRICT: *Bourgeau* 440; along road near San Angel, *Hitchcock* 5952.



**97. OPIZIA** Presl, Rel. Haenk. 1: 293. *pl.* 41. *f.* 1. 1830.**1. Opizia stolonifera** Presl, Rel. Haenk. 1: 293. *pl.* 41. *f.* 1. 1830.

Type locality, "Acapulco."

RANGE: Southern Mexico and Cuba.

HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, *Palmer* 615 in 1886. Tequila, thin, gravelly soil, *Pringle* 4566.COLIMA: Coquimatlán, along railway, *Hitchcock* 7052.PUEBLA: Atlixco, *Nelson* in 1893.MORELOS: Yautepec, roadside, *Pringle* 11237. Cuernavaca, open ground, *Hitchcock* 6817; roadside, where trodden, *Hitchcock* 6842.GUERRERO: Acapulco, *Palmer* 42 in 1894. Balsas, along railway, *Hitchcock* 6783, 6804. Apipilulco, prairie, *Hitchcock* 6771.OAXACA: Oaxaca, base of hill, *Hitchcock* 6097. Tomellín, *Rose, Painter & Rose*, 10051, 10052; open ground along track, *Hitchcock* 6239.**98. PRINGLEOCHLOA** Scribn. Bot. Gaz. 21: 137. *pl.* 13. 1896.**1. Pringleochloa stolonifera** Scribn. Bot. Gaz. 21: 138. *pl.* 13. 1896.Type locality, "calcareous plains around Tehuacán in eastern Puebla," the type specimen collected by *Pringle* (no. 6280).

RANGE: Known only from the type locality.

HERBARIUM SPECIMENS:

PUEBLA: Tehuacán, dry plains, *Pringle* 6280; calcareous soil, *Pringle* 9560; *Rose & Rose* 11440; old field, *Hitchcock* 6036; open sterile soil among cactus, *Hitchcock* 6071.**99. PAPPOPHORUM** Schreb. Gen. Pl. 2: 787. 1791.

## KEY TO THE SPECIES.

Nodes bearded; culms decumbent, spreading; panicle spike-like,

lead-colored..... 1. *P. wrightii*.

Nodes glabrous; culm erect, panicle tawny.

Body of lemma 1 to 2 mm. long, the longer awns as much as

1 cm. long; panicle rather loose, 30 to 50 cm. long..... 3. *P. laguroideum*.

Body of lemma 3 to 4 mm. long, the longer awn about 5 mm.

long..... 2. *P. vaginatum*.**1. Pappophorum wrightii** S. Wats. Proc. Amer. Acad. 18: 178. 1883.

Type locality, "Llano Estacado, in deep ravines," Texas.

RANGE: Southwestern United States to Bolivia.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Los Angeles Bay, Gulf of California, *Palmer* 511 in 1887. Calmallí, common on rocky slope, *Orcutt* in 1899.SONORA: Guaymas, *Palmer* 511 in 1887. Hermosillo, rocky cliff, *Hitchcock* 3608.CHIHUAHUA: Chihuahua, mesa, *Hitchcock* 7801; rocky hills, *Pringle* 483.DURANGO: Durango, rocky hill, Iron Mountain, *Hitchcock* 7638; *Palmer* 721 in 1896. Torreón, rocky hill, *Hitchcock* 7542.COAHUILA: Saltillo, among rocks on hillsides, *Palmer* 395 in 1898. Parras, *Palmer* 1361 in 1880.SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 947 in 1878.QUERÉTARO: Querétaro, rocky hill, *Hitchcock* 5847.HIDALGO: Tula, dry calcareous bluffs, *Pringle* 11238.PUEBLA: Tehuacán, sterile soil, among cactus, *Hitchcock* 6070.OAXACA: Monte Albán, thin soil of limestone ledges, *Pringle* 4846. Oaxaca, rocky hill, *Hitchcock* 6144.



**2. *Pappophorum vaginatum*** Buckl. Prel. Rep. Geol. Agr. Surv. Tex. App. 1. 1866.*Pappophorum apertum* Munro; Scribn. Bull. Torrey Club 9: 148. 1882.

Type locality, "Western Texas."

RANGE: Southwestern United States and northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Guaymas, *Palmer* 350 in 1887.DURANGO: Tlahualilo, barren hills, *Pittier* 479.COAHUILA: Saltillo, garden, *Palmer* 256 in 1898; in cemeteries, *Palmer* 377 in 1898; dry ground, river bottom, *Hitchcock* 5635; dry ground in irrigation ditch, *Hitchcock* 5611. Parras, *Palmer* 1360 in 1880. Monclova, *Palmer* 1362 in 1880.NUEVO LEÓN: Monterey, dry calcareous banks, *Pringle* 1973.**3. *Pappophorum laguroideum*** Schrad. in Schult. Mant. 2: 342. 1824.

Type locality, "In India occidentali."

RANGE: West Indies and southern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

OAXACA: Quiotepec ad Río Grande, *Liebmann* 670. Tomellín Canyon, *Pringle* 4814; Tomellín, rocky bank near river, *Hitchcock* 6197.**100. *COTTEA*** Kunth, Rév. Gram. 1: 84. 1829.**1. *Cottea pappophoroides*** Kunth, Rév. Gram. 1: 84. 1829.

Type locality, "Peruvia."

RANGE: Southwestern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Guaymas, *Palmer* 339 in 1887.CHIHUAHUA: Chihuahua, rocky hills, *Pringle* 420. Southwestern Chihuahua, *Palmer* 162 in 1885.DURANGO: Torreón, rocky hill, *Hitchcock* 7543.SAN LUIS POTOSÍ: Sierra de Guascama, *Purpus* 5419.JALISCO: Bolaños, *Rose* 2914.OAXACA: Tomellín, rocky cliff, *Hitchcock* 6201.**101. *SCLEROPOGON*** Phil. Anal. Univ. Chile 36: 205. 1870.**1. *Scleropogon brevifolius*** Phil. Anal. Univ. Chile 36: 206. 1870.

Type locality, "Mendoza."

RANGE: Southwestern United States to Argentina and Chile.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Plains, *Pringle* 484. Santa Eulalia Plains, *Wilkinson* in 1885. Colonia Díaz, *Nelson* 6440. Candelaria, *Stearns* 254.COAHUILA: Parras, *Purpus* 5005. Saltillo, *Palmer* 280 in 1898. Chojo Grande, *Palmer* 340 in 1904.ZACATECAS: Hacienda de Cedros, *Lloyd* 169.SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 925 and 949 in 1878; *Schaffner* 135, 162.HIDALGO: Telles, *Orcutt* 4143.PUEBLA: San Marcos, railway embankment, *Hitchcock* 6508. Chalchicomula, dry ground along railway, forming close sod, *Hitchcock* 6270.**102. *MONANTHOCHLOË*** Engelm. Trans. Acad. St. Louis 1: 436. 1859.**1. *Monanthochloë littoralis*** Engelm. Trans. Acad. St. Louis. 1: 436. 1859.

Type locality, Texas.

RANGE: Coasts of tropical and subtropical seas of the Western Hemisphere.



## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: La Paz, *Brandegge* 3 in 1890. Magdalena Bay, *Brandegge* in 1893. Without locality, *Palmer* in 1890.

SONORA: Guaymas, stony beach, about edge of high tide, *Chase* 5508; along the beach, *Rose, Standley & Russell* 12581.

SINALOA: Altata, *Rose* 1370.

TAMAULIPAS: Tampico, brackish mud flat, *Hitchcock* 5779.

103. **MUNROA** Torr. U. S. Rep. Expl. Miss. Pacif. 4: 158. 1856.1. **Munroa squarrosa** (Nutt.) Torr. U. S. Rep. Expl. Miss. Pacif. 4: 158. 1856.

*Crypsis squarrosa* Nutt. Gen. Pl. 49. 1818.

Type locality, "On arid plains near the 'Grand Detour' of the Missouri."

RANGE: Dakotas and Montana to Utah, south to northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Colonia Díaz, *Nelson* 6457. Ciudad Juárez, sandy soil, *Pringle* 11236.

104. **ORCUTTIA** Vasey, Bull. Torrey Club 13: 219. *pl.* 60. 1886.1. **Orcuttia californica** Vasey, Bull. Torrey Club 13: 219. *pl.* 60. 1886.

Type locality, "near San Quentin Bay, Lower California," the type specimen collected by Orcutt (no. 1439).

RANGE: Known only from the type collection.

105. **GYNERIUM** Humb. & Bonpl. Pl. Aequin. 2: 112. *pl.* 115. 1809.1. **Gynerium sagittatum** Beauv. Ess. Agrost. 138. *pl.* 24. *f.* 6. 1812.

Type locality not given, but Peru implied.

RANGE: West Indies and southern Mexico to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Pital, *Liebmann* 679.

OAXACA: Trapiche de la Concepción, *Liebmann* 680.

106. **ARUNDO** L. Sp. Pl. 81. 1753.1. **Arundo donax** L. Sp. Pl. 81. 1753.

GIANT REED.

Type locality, "in Hispania, Galloprovincia."

RANGE: Warmer parts of the Old World, cultivated in America and escaped from Texas to California and southward.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandegge* 3 in 1899, 5 in 1890. Colorado River below mouth of Hardy River, *Mearns* 2839.

SONORA: Hermosillo, along dike, *Chase* 5505; irrigated field, *Rose, Standley & Russell* 12499. Bovispe, *Hartman* 178.

CHIHUAHUA: Chuichupa in the Sierra Madre, *Townsend & Barber* 399. South-western Chihuahua, *Palmer* 51a in 1885.

COAHUILA: Monclova, *Palmer* 1345 in 1880.

NUEVO LEÓN: Monterey, forming thickets along river, *Hitchcock* 5557.

TAMAULIPAS: Tampico, *Palmer* 143 in 1910.

TEPIC: María Cleofas Island, *Nelson* 4332.

GUANAJUATO: Guanajuato, *Dugès* 1134.

VERACRUZ: Veracruz, sand hill, *Hitchcock* 6563.

YUCATÁN: Common on the coast in "aguadas and cenotes," *Gaumer* 1141.



107. **PHRAGMITES** Trin. Fund. Agrost. 134. 1820.

- 1.
- Phragmites phragmites**
- (L.) Karst. Deutsch. Fl. 378. 1883. REED.

*Arundo phragmites* L. Sp. Pl. 81. 1753.

Type locality, "in Europæ lacubus fluviis."

RANGE: Throughout the temperate regions of the world.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Agueda, *Palmer* 211 in 1890. Wild Island, *McGee* in 1896.COLIMA: Manzanillo, *Palmer* 1092 in 1890.TABASCO: San Juan Bautista, *Rovirosa* 651.108. **TRIDENS** Roem. & Schult. Syst. Veg. 2: 34, 599. 1817.

## KEY TO THE SPECIES.

- Panicle included in fascicles of leaves; low plants with stolons... 7. *T. pulchellus*.
- Panicle exserted; plants not stoloniferous (except nos. 5 and 6).
- Panicle open, the branches spreading, the spikelets scattered.
- Lemmas 2 mm. long; panicles 3 cm. or more long; spikelets not over 5 mm. long..... 3. *T. eragrostoides*.
- Lemmas 4 mm. long; panicle rarely over 12 cm. long; spikelets about 8 mm. long..... 4. *T. texanus*.
- Panicle contracted or sometimes spike-like; spikelets crowded.
- Panicle long and narrow; lemmas awnless.
- Lemmas glabrous; spikelets 5 to 6 mm. long; blades flat..... 1. *T. albescens*.
- Lemmas pilose; spikelets about 8 mm. long; blades involute..... 2. *T. muticus*.
- Panicle short, oval; lemmas awned, very pilose.
- Lemmas acuminate, the awn from a slightly notched apex..... 6. *T. pilosus*.
- Lemmas truncate, the awn from between two rounded lobes..... 5. *T. avenaceus*.

- 1.
- Tridens albescens**
- (Munro) Woot. & Standl., N. Mex. Agric. Sta. Bull. 81: 129. 1912.

*Tricuspis albescens* Munro; Gray, Proc. Acad. Phila. 1862: 335. 1863, nomen nudum.*Triodia albescens* Vasey, U. S. Dept. Agr. Div. Bot. Bull. 12<sup>2</sup>: pl. 33. 1891.

Type locality, Texas.

RANGE: Kansas and Louisiana to Arizona and Coahuila.

HERBARIUM SPECIMEN FROM MEXICO:

COAHUILA: Río Grande Valley near Díaz, *Pringle* 9023.

- 2.
- Tridens muticus**
- (Torr.) Nash in Small, Fl. Southeast. U. S. 142. 1903.

*Tricuspis mutica* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 156. 1856.

Type locality, "Laguna Colorado, New Mexico."

RANGE: Southwestern United States and northern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Nogales to Cocospora Ranch, *Griffiths* 6831. Loquka Ranch to Altar, *Griffiths* 6907.CHIHUAHUA: Santa Eulalia Mountains, dry calcareous soil, *Pringle* 405.DURANGO: Tlahualilo, barren hills, *Pittier* 468.

- 3.
- Tridens eragrostoides**
- (Vasey & Scribn.) Nash in Small, Fl. Southeast. U. S. 142. 1903.

*Triodia eragrostoides* Vasey & Scribn. Contr. U. S. Nat. Herb. 1: 58. 1890.



Type locality, "Texas," the type specimen collected by Nealley in 1892 at San Diego.

RANGE: Florida to Texas and south to Nuevo León.

HERBARIUM SPECIMEN FROM MEXICO:

NUEVO LEÓN: Monterey, hills, *Pringle* 1972.

4. *Tridens texanus* (Thurb.) Nash in Small, Fl. Southeast. U. S. 142. 1903.

*Triodia texana* S. Wats. Proc. Amer. Acad. 18: 180. 1883.

*Tricuspis texana* Thurb.; S. Wats. loc. cit. as synonym of *Triodia texana*.

Type locality, "Western Texas."

RANGE: Texas to San Luis Potosí.

HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Rio Grande Valley near Díaz, *Pringle* 9019. Monclova, *Palmer* 1371 in 1880.

NUEVO LEÓN: Monterey, hills, *Pringle* 1970; edge of field, *Hitchcock* 5525.

TAMAULIPAS: Victoria, *Palmer* 372 in 1907.

SAN LUIS POTOSÍ: Guascama *Purpus* 5422. Bagre, *Purpus* 5435.

5. *Tridens avenaceus* (H. B. K.).

*Triodia avenacea* H. B. K. Nov. Gen. & Sp. 1: 156. pl. 48. 1816.

Type locality, "In convalle Mexicana inter montem Chapultepec et Penol de los Banos."

RANGE: Texas to Arizona and south to South America.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Santa Eulalia Plains, *Wilkinson* 350. Santa Eulalia Mountains, *Pringle* 406.

COAHUILA: Jaral, *Schumann* 1740. Saltillo, in tufts on rocky hillsides, *Palmer* 262, 414, and 813 in 1898; *Palmer* 735 in 1905. Parras, *Ross* 1526.

ZACATECAS: Concepción del Oro, *Palmer* 265 and 280 in 1904. Hacienda de Cedros, foot slopes and hills, *Lloyd* 180, 232. Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7512.

AGUASCALIENTES: Aguascalientes, sterile, rocky hill, *Hitchcock* 7466.

SAN LUIS POTOSÍ: Cárdenas, dry limestone hills, *Pringle* 3930. San Luis Potosí, *Griffiths* 6514; *Schaffner* 159, 160. Las Canoas, rocky hill, *Hitchcock* 5767. En route from San Luis Potosí to San Antonio, Texas, *Parry & Palmer* 950 in 1878. Bagre, *Purpus* 5427.

QUERÉTARO: Querétaro, rocky hill, *Hitchcock* 5853.

HIDALGO: Ixmiquilpan, limestone hillside, *Rose, Painter & Rose* 8886, 8959. Pachuca, rocky hill, *Hitchcock* 6707.

FEDERAL DISTRICT: Hills, *Pringle* 9586; *Schaffner* 158.

PUEBLA: Mount Orizaba, barren slopes, *Seaton* 248. San Luis Tultitlanapa, *Purpus* 3594. Esperanza, barren hills, *Pittier* 419; rocky hill, *Hitchcock* 6475.

6. *Tridens pilosus* (Buckl.).

*Uralespis pilosa* Buckl. Proc. Acad. Phila. 1862: 95. 1863.

*Triodia acuminata* (Munro) Vasey, U. S. Dept. Agr. Div. Bot. Bull. 12<sup>2</sup>: pl. 32. 1891.

Type locality, "Middle Texas."

RANGE: Kansas to Nevada and south to San Luis Potosí.

HERBARIUM SPECIMENS FROM MEXICO:

COAHUILA: Díaz, calcareous soil, *Pringle* 8306.

NUEVO LEÓN: Monterey, by irrigation ditch, *Hitchcock* 5536; *Canby* 271.

SAN LUIS POTOSÍ: En route from San Luis Potosí to San Antonio, Texas, *Parry* 948 in 1878.

7. *Tridens pulchellus* (H. B. K.) Hitchc. in Jepson, Fl. Calif. 1: 141. 1912.

*Triodia pulchella* H. B. K. Nov. Gen. & Sp. 1: 155. pl. 47. 1816.



Type locality, "In subfrigidis, siccis, apricis regni Mexicani inter Guanaxuati, Mina de Belgrado et Cubilete."

RANGE: Texas to Utah and south to southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra Cantillas, *Orcutt* in 1884. Lagoon Head, *Palmer* 652 in 1889. Los Angeles Bay, Gulf of California, *Palmer* 500 in 1887. Calmallí, *Orcutt* in 1899. Granite hills west of Lake Maquata, Colorado Desert, *Orcutt* 2029.

SONORA: Agua Dulce, *MacDougal* in 1907. Guaymas, *Palmer* 500 in 1887. Paso de Luis, *Mearns* 2707.

CHIHUAHUA: Santa Eulalia Plains, *Wilkinson* in 1885. Near Lake Santa Maria, *Nelson* 6414. Chihuahua, along dry run, *Hitchcock* 7777; hills and plains, *Pringle* 496.

DURANGO: Torreón, rocky hill, *Hitchcock* 7547. Tlahualilo, barren hills, *Pittier* 480. Cerro de San Ignacio, *Purpus* 4616. Durango, on the south side of Iron Mountain, *Palmer* 740 in 1896.

COAHUILA: Saltillo, dry mesa, *Hitchcock* 5646; dense low tufts on dry, rocky hills, *Palmer* 257 and 413 in 1898. Parras, *Ross* 1530; *Palmer* 1359 in 1880.

ZACATECAS: Cedros, foot slopes and hills, *Lloyd* 89. Zacatecas, along dry river bed, *Hitchcock* 7536. Concepción del Oro, *Palmer* 263 in 1904.

AGUASCALIENTES: Aguascalientes, *Safford* 1365.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 161; *Parry & Palmer* 951 in 1878.

QUERÉTARO: Querétaro, rocky hill, *Hitchcock* 5854. Higuerillas, *Rose, Painter & Rose* 9790. San Pablo, *Rose, Painter & Rose* 9819. Loma del Ciervo, *Altamirano* 1611.

FEDERAL DISTRICT: *Ross* 122.

HIDALGO: El Salto, *Rose & Painter* 7076, hills, *Pringle* 11248.

109. **ERAGROSTIS** Host, Icon. Gram. Austr. 4: 14. pl. 14. f. 11. 1809.

KEY TO THE SPECIES.

Plants perennial.

Panicle narrow, contracted or spike-like.

Panicle a long slender spike, as much as 30 cm. long. 11. *E. spicata*.

Panicle contracted, more or less interrupted, not spike-like.

Lemmas 1.5 to 2 mm. long; sheaths not hairy at the throat. .... 12. *E. diversiflora*.

Lemmas 3 mm. long; sheaths hairy at the throat. 13. *E. secundiflora*.

Panicle open, diffuse.

Spikelets nearly sessile, appressed along the main spreading branches of the panicle. .... 14. *E. sessilis*.

Spikelets on long pedicels.

Sheaths appressed-pilose; panicle purple, more than half the height of the plant. .... 15. *E. pectinacea*.

Sheaths glabrous.

Spikelets less than 10-flowered.

Panicle pilose in the lower axils; blades flat or involute toward tip only. .... 19. *E. lugens*.

Panicle glabrous in the axils or with a few scattered hairs only.

Lower lemma 2 mm. long; blades flat or involute toward tip; panicle narrow, the branches ascending. .... 17. *E. palmeri*.



- Lower lemma 3 mm. long; blades involute; panicle open, the branches spreading ..... 18. *E. erosa*.
- Spikelets more than 10-flowered.
- Culms tall, 1.5 to 2 meters high; blades 5 to 10 mm. wide ..... 16. *E. gigantea*.
- Culms less than 0.5 meter high; blades narrow.
- Spikelets linear, 1.5 mm. wide; pedicels stiffly spreading, mostly longer than the spikelets ..... 20. *E. elliottii*.
- Spikelets lanceolate, short-pedicelled, lead-colored ..... 21. *E. plumbea*.
- Plants annual.
- Palea conspicuously ciliate.
- Panicle contracted, more or less spike-like ..... 2. *E. ciliaris*.
- Panicle open ..... 3. *E. plumosa*.
- Palea not conspicuously ciliate.
- Spikelets dicecious or polygamous; plants stoloniferous ..... 1. *E. hypnoides*.
- Spikelets perfect.
- Spikelets 3 mm. wide, usually about 1 cm. long; panicle more or less contracted; keel of lemma glandular-scabrous ..... 8. *E. megastachya*.
- Spikelets not over 2 mm. wide.
- Panicle contracted, the branches spikelet-bearing from the base; spikelets sessile.
- Spikelets small, usually not over 3 mm. long; culms erect; panicles tawny, 10 to 20 cm. long, narrow, interrupted below ..... 10. *E. glomerata*.
- Spikelets linear, many-flowered, as much as 15 mm. long; culms low and spreading; panicle mostly tinged with red, oblong, 2 to 5 cm. long, sometimes longer and somewhat compound ..... 9. *E. amoena*.
- Panicle open.
- Foliage hirsute; plants delicate, 10 to 20 cm. high ..... 4. *E. scribneriana*.
- Foliage glabrous.
- Panicle pilose in the lower axils; spikelets 1 mm. wide; lemma 1.5 mm. long ..... 5. *E. pilosa*.
- Panicle glabrous in the axils; spikelets 2 to 2.5 mm. wide; lemma 2 mm. long.
- Panicle large and drooping, as much as 25 cm. long; spikelets 2 mm. wide ..... 6. *E. mexicana*.



Panicle short and erect, the  
branches rather divari-  
cately spreading, usually  
less than 10 cm. long;  
spikelets 2.5 mm. wide... 7. *E. limbata*.

1. **Eragrostis hypnoides** (Lam.) B. S. P. Prel. Cat. N. Y. 69. 1888.

*Poa hypnoides* Lam. Tabl. Encycl. 1: 185. 1791.

Type locality, "America merid."

RANGE: Throughout the United States and southward to the West Indies and South America.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San Gregorio, *Brandeggee* 21 in 1889. Comondú, *Brandeggee* 23 in 1899.

SAN LUIS POTOSÍ: En route from San Luis Potosí to Tampico, *Palmer* 1154 in 1880. Las Canóas, sandy bottom of dried pools in a barranca, *Pringle* 3699.

VERACRUZ: Papantla, *Liebmann* 537. Tlacotalpan, *Nelson* 511. Orizaba, *Bourgeau* 2638; *Botteri* 665. Panuco, *Palmer* 347 in 1910. Pital, *Liebmann* 534. Veracruz, *Müller* 2168.

GUERRERO: Acapulco, *Palmer* 596 in 1895.

OAXACA: Jamiltepec, *Nelson* 2364.

TABASCO: Laguna de la Polvora, *Rovirosa* 188.

2. **Eragrostis ciliaris** (L.) Link, Hort. Berol. 1: 192. 1827.

*Poa ciliaris* L. Syst. Nat. ed. 10. 875. 1759.

Type locality, Jamaica.

RANGE: Tropics and subtropics of both hemispheres.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandeggee* 4 in 1899, 8 in 1890. Miraflores, *Purpus* 291.

SONORA: Alamos, *Palmer* 688 in 1890; along arroyo, *Rose, Standley & Russell* 12701.

CHIHUAHUA: Without locality, *Palmer* in 1886.

SINALOA: Villa Unión, open field, *Rose, Standley & Russell* 13920. Culiacán, moist field, *Rose, Standley & Russell* 14866. Fuerte, sandy soil along river, *Rose, Standley & Russell* 13493. Rosario, along river, *Rose, Standley & Russell* 14599. Mazatlán, thickets, *Rose, Standley & Russell* 14056. Mountains at headwaters of Mazatlán River, *Wright* 1319. Lodiago, river bottom, often overflowed during rainy season, *Palmer* 1649 in 1891.

TAMAULIPAS: Tampico, *Palmer* 147 in 1910; along street, *Hitchcock* 5791. Victoria, *Palmer* 481 in 1907.

TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14244; *Rose* 3135.

SAN LUIS POTOSÍ: Rascón, *Purpus* 5424. En route San Luis Potosí to Tampico, *Palmer* 1152 in 1878.

JALISCO: Guadalajara, fields in the barranca, *Pringle* 1851.

COLIMA: Manzanillo, *Palmer* 1085 in 1890. Caleras, along railway, *Hitchcock* 7015. Alzada, weed in town, *Hitchcock* 7105. Colima, *Orcutt* 4586.

PUEBLA: Road to Mexico City, *Nicolas* in 1908.

VERACRUZ: Jalapa, along railway, *Hitchcock* 6635. Sanborn, *Orcutt* 3239. Veracruz, *Orcutt* 2895; along railway, *Hitchcock* 6560; *Müller* 2171. Colipa, *Liebmann* 546.

MORÉLOS: Yautepec, fields, *Pringle* 11223.

GUERRERO: Balsas, along railway, *Hitchcock* 6803. Acapulco, *Palmer* 39 in 1894.

OAXACA: Tomellín, along ditch, *Hitchcock* 6230. Cuicatlán, *Nelson* 1650a.

TABASCO: San Juan Bautista, *Rovirosa* 645.

YUCATÁN: Mérida, *Schott* 20, 619.



**3. *Eragrostis plumosa* (Retz.) Link, Hort. Berol. 1: 192. 1827.***Poa plumosa* Retz. Obs. Bot. 4: 20. 1786.

Type locality, "Tranquebaria," East Indies.

RANGE: Tropics and subtropics of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandeggee* 1 and 19 in 1890, and in 1902.COLIMA: Colima, *Palmer* 1266 in 1891; waste and cultivated ground, *Palmer* 15 in 1897. Manzanillo, *Palmer* 1266 in 1890. Coquimatlán, along railway, *Hitchcock* 7053. Alzada, between railway ties, *Hitchcock* 7108.PUEBLA: Puebla, prairies, *Nicolas* in 1910.GUERRERO: Acapulco, *Palmer* 40 in 1894. San Marco, *Nelson* 2270.TABASCO: San Juan Bautista, *Rovirosa* 690.YUCATÁN: Mérida, *Schott* 59. Without locality, *Gaumer* 851.**4. *Eragrostis scribneriana* nom. nov.***Eragrostis pusilla* Scribn.; Beal, Grasses N. Amer. 2: 481. November 11, 1896, not Hack. September, 1896.

Type locality, "Mexico (Jalisco)," the type specimen collected by Pringle (no. 2327).

RANGE: Known only from the type locality.

## HERBARIUM SPECIMENS:

JALISCO: Guadalajara, dry rocky hills, *Pringle* 2327; gravelly soil, *Pringle* 11741.**5. *Eragrostis pilosa* (L.) Beauv. Ess. Agrost. 71. 1812.***Poa pilosa* L. Sp. Pl. 68. 1753.

Type locality, "India."

RANGE: Temperate and warmer regions of both hemispheres.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Santa Agueda, *Palmer* 218 in 1890. Maleje, Gulf of California, *Palmer* 42 in 1887. Binveama (Cape Region), *Brandeggee* 7 in 1899. El Taste, *Brandeggee* 50 in 1893. Sierra de la Laguna, *Brandeggee* 82 in 1893. San José del Cabo, *Purpus* in 1901. Santa Rosalía, *Palmer* 145 in 1889.SONORA: Guaymas, *Palmer* 49 and 167 in 1887; in the public square, *Rose* 1281. Nogales to Cocospora Ranch, *Griffiths* 6793. Hermosillo, meadow by ditch, *Hitchcock* 3576; near river, *Hitchcock* 3593; along ditch, *Hitchcock* 3613. Valley of Río de Sonora, *Rose, Standley & Russell* 12491. Llano, along railway, *Hitchcock* 3521. Nogales, along railway, *Hitchcock* 3634. Alamos, *Rose, Standley & Russell* 13030, *Palmer* 689 in 1890. San Pedro River, *Mearns* 1148. Yaqui River, *Palmer* 6 in 1869.CHIHUAHUA: Batopilas, on the roof of Governor Shepherd's house, *Palmer* in 1885. Southwestern Chihuahua, *Palmer* 8 and 50F in 1885. Candelaria, *Stearns* 261. Between Casas Grandes and Sabinal, *Nelson* 6353.SINALOA: Lodiago, river bottom, *Palmer* 1651 in 1891. Rosario, *Rose* 1544, 1545, 1847; along the river, *Rose, Standley & Russell* 14584. Headwaters of Mazatlán River, *Wright* 1320. San Blas, gravel beds along river, *Rose, Standley & Russell* 13393. Topolobampo, *Palmer* 240 in 1897.DURANGO: Durango, *Palmer* in 1896; cultivated ground, *Palmer* 177, 183, and 726 in 1896; plains and arroyos, *Palmer* 764 in 1896; among mesquite bushes, *Palmer* 768 in 1896; along road, *Hitchcock* 7586. Torreón, weed in field, *Hitchcock* 7554. Tepehuanes, *Palmer* 266 in 1906. Tlahualilo, barren hills, *Pittier* 476.COAHUILA: Saltillo, *Palmer* 398 in 1904; in waste places, *Palmer* 811 and 812 in 1898; wet place, *Hitchcock* 5621, 5630.TAMAULIPAS: Victoria, *Palmer* 474 and 555 in 1907.TEPIC: Tepic, *Palmer* 1928 in 1892. Between Aguacate and Dolores, *Rose* 2016.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

ZACATECAS: Zacatecas, along dry river bed, *Hitchcock* 7532.

SAN LUIS POTOSÍ: Alvarez, *Palmer* 174 and 174½ in 1902. Cárdenas, irrigated field, *Hitchcock* 5725. San Luis Potosí, *Schaffner* 143; dry ditch, *Hitchcock* 5658.

JALISCO: Guadalajara, fields, *Pringle* 2430; wet meadows, *Pringle* 4492; prairie near San Pedro, *Hitchcock* 7298; *Holway* 1. San Nicolás, sterile hill, *Hitchcock* 7234; prairie, *Hitchcock* 7189.

GUANAJUATO: Acámbaro, *Rose* 3595.

HIDALGO: Huejutla, *Seler* 627.

COLIMA: Colima, *Palmer* 1262, 1273, and 1274 in 1891; roadsides, *Palmer* 13 in 1897. Caleras, along railway, *Hitchcock* 7016. Manzanillo, *Palmer* 1088 in 1890. Alzada, along railway, *Hitchcock* 7062.

MICHOACÁN: Morelia, *Arsène* 3361.

FEDERAL DISTRICT: *Pringle* 9580; *Orcutt* 4111.

PUEBLA: Tehuacán, river bottom, *Hitchcock* 6086.

VERACRUZ: Córdoba, weed, *Hitchcock* 6403; Orizaba, *Botteri* 662, 1270; open rocky hill, *Hitchcock* 6362. Consoquitla, *Liebmman* 520. Jalapa, along railway, *Hitchcock* 6600. Veracruz, weed along street, *Hitchcock* 6572.

MORELOS: Cuernavaca, weed in pasture, *Hitchcock* 6825; *Orcutt* 3884; along road, *Hitchcock* 6866, 6867.

OAXACA: Tomellín, *Rose, Painter & Rose* 10283, 10062; rocky bank, *Hitchcock* 6196; along track, *Hitchcock* 6215. Oaxaca, along railway track, *Hitchcock* 6121; along hedge, *Hitchcock* 6113. Valley of Oaxaca, *Conzatti & González* 346.

6. *Eragrostis mexicana* (Lag.) Link, Hort. Berol. 1: 190. 1827.

*Poa mexicana* Lag. Gen. & Sp. Nov. 3. 1816.

Type locality, "in Imperio Mexicano."

RANGE: Southwestern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: San José del Cabo, *Brandegge* 7 in 1890. Sierra de San Francisquito, *Brandegge* 24 in 1899.

SONORA: Guaymas, *Palmer* 167 in 1887; open gravelly place in yard, *Hitchcock* 3566.

CHIHUAHUA: Sierra Madre, *Nelson* 6300. Chihuahua Valley, *Pringle* 416. Southwestern Chihuahua, *Palmer* 8 in 1885. Miñaca, along dry run, *Hitchcock* 7733. Sánchez, along railway, *Hitchcock* 7689.

SINALOA: Fuerte, sandy soil along the river, *Rose, Standley & Russell* 13464.

DURANGO: Durango, cultivated and waste ground, *Palmer* 534, 723, 869, and 950 in 1896. Tepehuanes, *Palmer* 264 in 1906. Torreón, along ditch, *Hitchcock* 7726.

COAHUILA: Saltillo, cemeteries, *Palmer* 376 and 409 in 1898; cultivated ground near cemeteries, *Palmer* 411 in 1898; *Palmer* 710 in 1905; irrigated field, *Hitchcock* 5629; weed in park, *Hitchcock* 5642. Parras, *Palmer* 1367 in 1880.

ZACATECAS: Zacatecas, gulch in dry sterile hills, *Hitchcock* 7500; along dry river bed, *Hitchcock* 7531.

AGUASCALIENTES: Aguascalientes, weed, edge of field, *Hitchcock* 7443, 7451.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 142; dry ditch, *Hitchcock* 5659; field, *Hitchcock* 5661, 5662; *Griffiths* 6515. Alvarez, *Palmer* 170 in 1904. En route from San Luis Potosí to Tampico, *Parry & Palmer* 936 in 1878.

JALISCO: Colotlán, *Rose* 3605. Zapotlán, railway right of way, *Hitchcock* 7132, 7137. Chapala, *Rose* 3453, 3453a.

GUANAJUATO: Acámbaro, along railway, *Hitchcock* 6930. Irapuato, moist sandy-clay plain, *Hitchcock* 7418.

QUERÉTARO: Querétaro, weed in field, *Hitchcock* 5803; rocky field, *Hitchcock* 5843.



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6713; along road, *Hitchcock* 6724; sandy river bed, *Hitchcock* 6759, 6760.

COLIMA: Colima, *Palmer* 1262 in 1891; garden, *Palmer* 20 in 1897. Alzada, along railway, *Hitchcock* 7060.

MICHOACÁN: Morelia, *Arsène* in 1909.

MÉXICO: Popo Park, open woods, *Hitchcock* 6023. Toluca, weed in field, *Hitchcock* 6903. Federal District, *Holway* 3093; open ground, *Hitchcock* 5942; weed in field, *Hitchcock* 5897, 5901; *Orcutt* 3532, 3696; *Bourgeau* 445.

PUEBLA: Chalchicomula, *Rose & Hay* 5796; open dry ground, *Hitchcock* 6281; common weed in field, *Hitchcock* 6295, 6296. Tehuacán, along railway, *Hitchcock* 6055. Esperanza, along railway, *Hitchcock* 6496, 6503. San Baltazar, *Nicolas* in 1911.

VERACRUZ: Orizaba, *Botteri* 663. Córdoba, weed along track, *Hitchcock* 6399, 6402.

MORELOS: Cuernavaca, weed along road, *Hitchcock* 6857.

GUERRERO: Canyon de la Mano Negra near Iguala, *Rose, Painter & Rose* 9382. Balsas, along railway, *Hitchcock* 6795.

OAXACA: San Agustín, *Liebmann* 482. Tomellín, weed in cornfield, *Hitchcock* 6213.

7. *Eragrostis limbata* Fourn. Mex. Pl. 2: 116. 1886.

Type locality, "in scopulosis regni Mexicani," the type specimen collected by Bonpland (no. 4573).

RANGE: Southern California to Costa Rica.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: El Taste, *Brandegge* in 1902.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 50f in 1885. Miñaca, along railway, *Hitchcock* 7732. Sánchez, along stream in ravine, *Hitchcock* 7705.

SINALOA: Culiacán, moist field, *Rose, Standley & Russell* 14874.

DURANGO: Durango, weed in field, *Hitchcock* 7647. Iron Mountain, on one of the higher points, *Palmer* 531, 875, 876, and 950 in 1896; dry ground, *Hitchcock* 7609; rocky hill, *Hitchcock* 7640. San Ramón, *Palmer* 83 and 131 in 1906.

COAHUILA: Chojo Grande, *Palmer* 334 and 335 in 1904. Saltillo, weed in park, *Hitchcock* 5643; cemeteries, *Palmer* 410 in 1898; waste places around dwellings, *Palmer* 412 in 1898.

TEPIC: Acaponeta, moist ravine, *Rose, Standley & Russell* 14321. Tepic, shady spots along arroyos, *Palmer* 1928 in 1892.

SAN LUIS POTOSÍ: Cárdenas, irrigated field, *Hitchcock* 5715.

JALISCO: San Nicolás, sterile clay field, *Hitchcock* 7205; prairie, *Hitchcock* 7185. Guadalajara, on roof of hotel, *Hitchcock* 7263; prairie near San Pedro, *Hitchcock* 7285; side of Barranca de Oblatos, *Hitchcock* 7347; fields, *Pringle* 3839; *Palmer* 234 in 1886. Zapotlán, railway right of way, *Hitchcock* 7140. Bolaños, *Rose* 3699. Chapala, *Rose* 3497.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7419. Acámbaro, along railway, *Hitchcock* 6925.

HIDALGO: Pachuca, open ground, *Hitchcock* 6725. Telles, *Orcutt* 4149. Tequisquiatic, *Rose & Painter* 8019.

MICHOACÁN: Uruápan, prairie, *Hitchcock* 6987.

MÉXICO: Popo Park, open ground, *Hitchcock* 6027, 6689. Toluca, weed in field, *Hitchcock* 6904. Federal District, *Rose & Painter* 6823, 9253; *Orcutt* 3594; lava beds, *Pringle* 6459; *Bourgeau* 437, 1305.

PUEBLA: Tehuacán, limestone hills, *Rose, Painter & Rose* 9907; alfalfa field, *Hitchcock* 6031; plains, *Pringle* 9604; cactus hill, *Hitchcock* 6089. Atlixco,



## HERBARIUM SPECIMENS FROM MEXICO—Continued.

*Nelson* in 1893. San Luis Tultitlanapa, *Purpus* 3599. Chalchicomula, open dry ground, *Hitchcock* 6282; common weed, waste and cultivated ground, *Hitchcock* 6293, 6294, 6309. Esperanza, along railway, *Hitchcock* 6466. Rancho Tosados, *Nicolas* in 1909. Oriental, *Orcutt* 3948.

VERACRUZ: Orizaba, weed in street, *Hitchcock* 6311; roadside ditch, *Hitchcock* 6329, 6333; *Hahn* 2635; *Botteri*; *Müller* 2121. Córdoba, *Orcutt* 3254. Omealca, *Orcutt* 3253. Jalapa, along railway, *Hitchcock* 6602.

OAXACA: Valley of Oaxaca, *Conzatti & González* 345. Escuela Normal, *Conzatti* 14. Oaxaca, along road, *Hitchcock* 6112; along railway, *Hitchcock* 6126. Cuicatlán, hills, *Nelson* 1705.

8. *Eragrostis megastachya* (Koel.) Link, Hort. Berol. 1: 187. 1827.

*Poa megastachya* Koel. Descr. Gram. 181. 1802.

Type locality given as "in Europa australi ad agrorum versuras."

RANGE: Throughout the United States and south to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Maleje, Gulf of California, *Palmer* 40 in 1887. San José del Cabo, *Brandegge* 9 in 1890. Santa Agueda, *Palmer* 215 in 1890. Without locality, *Orcutt* in 1889.

SONORA: Guaymas, open gravelly place in yard, *Hitchcock* 3567; *Palmer* 40 and 40½ in 1887. Along railway 10 miles south of Nogales, Arizona, *Hitchcock* 3628. Llano, along railway at station, *Hitchcock* 3520. Hermosillo, in meadow along river, *Hitchcock* 3574; sandy bed of river, *Hitchcock* 3617. Loquka Ranch to Altar, *Griffiths* 6901. San Pedro River, *Mearns* 1147.

CHIHUAHUA: Santa Eulalia Plains, *Wilkinson* in 1885. Miñaca, along railway, *Hitchcock* 7738.

DURANGO: Tlahualilo, barren hills, *Pittier* 475. Durango, *Palmer* 720 in 1896; dry ground, *Hitchcock* 7597.

COAHUILA: Sabinas, *Nelson* 6823. Saltillo, cultivated ground, *Palmer* 389 in 1898; weed in field, *Hitchcock* 5633.

TAMAULIPAS: Victoria, *Palmer* 473 in 1907.

ZACATECAS: Zacatecas, along dry river bed, *Hitchcock* 7534.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 139; *Parry & Palmer* 934 in 1878; alfalfa field, *Hitchcock* 5696.

GUANAJUATO: Irapuato, moist sandy-clay plain, *Hitchcock* 7417.

QUERÉTARO: Querétaro, weed in park, *Hitchcock* 5840.

HIDALGO: Pachuca, along railway, *Hitchcock* 6770.

COLIMA: Jala, along railway, *Hitchcock* 7012.

PUEBLA: Tehuacán, limestone hills at El Riego, *Rose, Painter & Rose* 9908; bottom land field, *Hitchcock* 6069.

MORELOS: Yautepec, along railroad, *Rose, Painter & Rose* 8570.

GUERRERO: Canyon de la Mano Negra, near Iguala, *Rose, Painter & Rose* 9387. Balsas, along railway, *Hitchcock* 6794.

OAXACA: Cuicatlán, *Nelson* 1651. Tomellín, *Rose, Painter & Rose* 10080; along railway, *Hitchcock* 6232; rocky hill, *Hitchcock* 6243. Oaxaca, weed in field, *Hitchcock* 6123.

9. *Eragrostis amoena* Presl, Rel. Haenk. 1: 275. 1830.

Type locality, "Mexico."

RANGE: Western Mexico to Panama.

## HERBARIUM SPECIMENS FROM MEXICO:

TEPIC: Tepic, shady spots along arroyos, *Palmer* 1926 in 1892.

JALISCO: Guadalajara, sandy plains, *Pringle* 3334, 11742; dry open ground, rim of Barranca de Oblatos, *Hitchcock* 7323.

VERACRUZ: Coatzacoalcos, *Smith* 1051.

GUERRERO: Acapulco, *Palmer* 596 in 1895.



**10. *Eragrostis glomerata* (Walt.) Dewey, Contr. U. S. Nat. Herb. 2: 543. 1894.***Poa glomerata* Walt. Fl. Carol. 80. 1788.*Eragrostis pallida* Vasey, Contr. U. S. Nat. Herb. 1: 285. 1893.

Type locality, presumably South Carolina.

RANGE: Southern United States to South America.

## HERBARIUM SPECIMENS FROM MEXICO:

COLIMA: Colima, *Palmer* 1268 in 1891 (type of *E. pallida* Vasey).MORELOS: Cuernavaca, wet places, *Pringle* 6605.**11. *Eragrostis spicata* Vasey, Bot. Gaz. 16: 146. 1891.**

Type locality, "San José del Cabo, Lower California," the type specimen collected in 1890 by Brandegee (no. 10).

RANGE: Known only from the type collection.

**12. *Eragrostis diversiflora* Vasey, Contr. U. S. Nat. Herb. 1: 285. 1893.**

Type locality, "Manzanillo," Mexico, the type specimen collected by Palmer (no. 1335).

RANGE: Pacific slope of Mexico.

## HERBARIUM SPECIMENS:

SINALOA: Mountains at headwaters of Mazatlán River, *Wright* 1318. Mazatlán, dry field, *Rose, Standley & Russell* 14130.COLIMA: Manzanillo, *Palmer* 1335 and 1385 in 1891. Revillagigedo Islands, *Barkewell* 172.**13. *Eragrostis secundiflora* Presl, Rel. Haenk. 1: 276. 1830.**

Type locality, "Mexico."

RANGE: Middle and southern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: La Barra, *Palmer* 591 in 1910 in part. Tampico, sand dunes, *Hitchcock* 5794.VERACRUZ: Coatzacoalcas, *Orcutt* 3103. Veracruz, sand dunes, *Pringle* 8520; sandy prairie, *Hitchcock* 6559; *Orcutt* 3250.OAXACA: Pochutla, La Jalera, *Liebmann* 538.YUCATÁN: Sisal, sea shore, *Schott* 640.**14. *Eragrostis sessilis* (Pursh) Buckl. Proc. Acad. Phila. 1862: 97. 1863.**

Type locality, "Near Austin, Texas."

RANGE: Southwestern United States and Chihuahua.

## HERBARIUM SPECIMEN FROM MEXICO:

CHIHUAHUA: Near Lake Santa María, *Nelson* 6413.**15. *Eragrostis pectinacea* (Michx.) Nees, Fl. Afr. Austr. 406. 1841.***Poa pectinacea* Michx. Fl. Bor. Amer. 1: 69. 1803.

Type locality, "in arvis Illinoensibus."

RANGE: Northeastern United States to San Luis Potosí.

## HERBARIUM SPECIMEN FROM MEXICO:

SAN LUIS POTOSÍ: Cárdenas, dry hills, *Pringle* 3284.**16. *Eragrostis gigantea* Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1: 403. 1830.**

Type locality, "Doming[o]."

RANGE: West Indies and coast of Veracruz.

## HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Veracruz, flat land back of beach among bull-thorn acacia, *Hitchcock* 6580.**17. *Eragrostis palmeri* S. Wats. Proc. Amer. Acad. 18: 182. 1883.**

Type locality, "Juraz, on the Sabinas River, Coahuila," the type specimen collected by Palmer (no. 1368).

RANGE: Known only from the type collection.



**18. *Eragrostis erosa* Scribn.; Beal, Grasses N. Amer. 2: 483. 1896.**

Type locality, "Mexico (Chihuahua)," the type specimen collected in the Santa Eulalia Mountains by Pringle, no. 415.

RANGE: Known only from Chihuahua.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Santa Eulalia Plains, *Wilkinson* 341; Santa Eulalia Mountains, *Pringle* 415.

**19. *Eragrostis lugens* Nees, Agrost. Bras. 505. 1829.**

Type locality, "ad Monte Video et in confinibus regni Paraguayan," the type specimen collected by Sello.

RANGE: Southwestern United States to Argentina.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: El Taste, *Brandege* in 1902. Sierra de la Laguna, *Brandege* 28 in 1899. Sierra de San Francisquito, *Brandege* 10 and 20 in 1899.

CHIHUAHUA: Sierra en Media, *Nelson* 6467.

DURANGO: Durango, dry ground, *Hitchcock* 7598. Iron Mountain, higher points, *Palmer* 531 in 1896; among the rocks, *Palmer* 727 in 1896.

COAHUILA: Saltillo, cornfield, *Hitchcock* 5597; sandy field near river, *Hitchcock* 5627; rich soil, *Palmer* 408 in 1898.

ZACATECAS: Zacatecas, gulch in dry sterile hills, *Hitchcock* 7515.

SAN LUIS POTOSÍ: San Luis Potosí, edge of field, *Hitchcock* 5672; *Parry & Palmer* 938 in 1878; *Schaffner* 138. Cárdenas, railway cut, *Hitchcock* 5731. Alvarez, *Palmer* 172 in 1904.

JALISCO: Zapotlán, damp soil, railway right of way, *Hitchcock* 7111; pine woods, hillside, *Hitchcock* 7242. Guadalajara, *Palmer* 203 and 234 in 1886.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6714, 6743. Tula, valley, *Pringle* 6634.

MICHOACÁN: Uruápan, along road, *Hitchcock* 6960; prairie, *Hitchcock* 6968; weed along railway, *Hitchcock* 6991. Jacuaro, along railway, *Hitchcock* 6956.

MÉXICO: Río Hondo, *Holway* 5. Popó Park, open ground, *Hitchcock* 6020. Toluca, rocky hill, *Hitchcock* 6888. Hacienda de la Encarnación, *Rose, Painter & Rose* 8453. Federal District, field, *Hitchcock* 5912, 5924; open meadow, *Hitchcock* 5934; depression in lava rock, *Hitchcock* 5959; *Orcutt* 3694; *Bourgeau* 228, 673; *Pringle* 9602; *Rose & Hay* 5508.

PUEBLA: Esperanza, rocky hill, *Hitchcock* 6491. San Marcos, railway embankment, *Hitchcock* 6523, 6534. Chinantla, *Liebmann* 527. Cerro Guadalupe, *Nicolas* in 1909. Cerro del Gavilán, *Purpus* 4220.

VERACRUZ: Orizaba, roadside ditch, *Hitchcock* 6337, 6338; open rocky hill, *Hitchcock* 6367; *Botteri* 682; *Bourgeau* 2643. Jalapa, clay cut, *Hitchcock* 6601, 6677. Mirador, *Liebmann* 526.

**20. *Eragrostis elliotii* S. Wats. Proc. Amer. Acad. 25: 140. 1890.**

Type locality, "Paris Island," presumably off the coast of South Carolina or Georgia.

RANGE: Southern United States, Gulf coast of Mexico and the West Indies.

## HERBARIUM SPECIMENS FROM MEXICO:

TAMAULIPAS: Tampico, sand dunes, *Hitchcock* 5799.

VERACRUZ: Veracruz, sandy prairie, *Hitchcock* 6553; wet sands, *Pringle* 5561; *Orcutt* 3251.

**21. *Eragrostis plumbea* Scribn.; Beal, Grasses N. Amer. 2: 484. 1896.**

Type locality, "Mexico (Guadalajara)."

RANGE: San Luis Potosí to Michoacán and Veracruz.



## HERBARIUM SPECIMENS:

SAN LUIS POTOSÍ: Cárdenas, railway cut, *Hitchcock* 5717; damp clay, along railway, *Hitchcock* 5777.

JALISCO: Guadalajara, near water in ditch, road to Barranca de Oblatos, *Hitchcock* 7321; wet soil, *Pringle* 2311, 11740; *Palmer* 240 in 1886.

COLIMA: Alzada, along railway, *Hitchcock* 7061.

MICHOACÁN: Morelia, *Arsène* in 1909.

PUEBLA: Tehuacán, along railway, *Hitchcock* 6058.

VERACRUZ: Veracruz, sandy prairie, *Hitchcock* 6557.

110. *MELICA* L. Sp. Pl. 66. 1753.

## KEY TO THE SPECIES.

Fertile florets 1 or 2 in each spikelet; spikelets 4 to 6 mm. long.

Primary branches of panicle ascending..... 1. *M. imperfecta*.

Primary branches of panicle more or less reflexed..... 1a. *M. imperfecta flexuosa*.

Fertile florets 3 or 4 in each spikelet.

Plants tall and rather stout, somewhat woody; second glume 10 to 12 mm. long..... 4. *M. frutescens*.

Plants herbaceous, slender; second glume 8 mm. long.

Panicle nearly simple, with 1 or 2 short appressed branches. 2. *M. porteri*.

Panicle compound, the branches spreading or reflexed... 3. *M. alba*.

1. *Melica imperfecta* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 2<sup>1</sup>: 59. 1836.

Type locality, California.

RANGE: Pacific slope from San Francisco Bay through Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Cedros Island, *Palmer* 660 and 662 in 1889. San Quentín Bay, *Palmer* 685 and 727 in 1889. Todos Santos Island, *Anthony* 203.

1a. *Melica imperfecta flexuosa* Boland. Proc. Calif. Acad. 4: 101. 1870.

Type locality, "on rocks on the road from Mariposa to Clark's," Yosemite National Park, California.

RANGE: Pacific slope, Yosemite region to Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: El Rancho Viejo, *Brandeggee* 14 in 1889. Nachognero Valley, *Schoenfeldt* 3438. San Antonio Valley, *Brandeggee* 120. Without locality, *Orcutt* in 1886.

2. *Melica porteri* Scribn. Proc. Acad. Phila. 1885: 44. pl. 1. f. 17, 18. 1886.

*Melica mutica parviflora* Porter in Port. & Coult. Syn. Fl. Colo. 149. 1874.

*Melica parviflora* Scribn. Mem. Torrey Club 5: 50. 1894.

Type locality, Colorado.

RANGE: Rocky Mountain region from Colorado to Chihuahua, occasional on bluffs in Missouri and Texas.

## HERBARIUM SPECIMEN FROM MEXICO:

CHIHUAHUA: Sierra Madre, *Pringle* 2045.

3. *Melica alba* sp. nov.

Perennial; culms cespitose, slender, erect, glabrous, 0.5 to 1 meter high; sheaths minutely roughened; ligule thin, white, membranaceous, soon lacerate, 5 to 10 mm. long; blades flat, minutely scabrous, 10 to 20 cm. long, 2 to 3 mm. wide, the lower shorter, or reduced to sheaths; panicle narrow, 10 to 15 cm. long, the branches rather



distant, ascending or appressed; pedicels slender, 3 to 5 mm. long, enlarged and pubescent toward the recurved tip; spikelets with one perfect floret, racemose, more or less secund along the main branches, shining white, 7 to 8 mm. long; first glume as long as the spikelet, oblong, obtuse, 5-nerved, the nerves anastomosing above, thin, the broad margin white and papery, infolding the base of the spikelet, flattened above, minutely scabrous; second glume similar to the first, somewhat narrower, 3-nerved; lemma about as long as the glumes, narrower, firm except the obtuse scarious summit, many-nerved, the nerves not extending into the summit, tuberculate-roughened, bearing a group of flat, lax, twisted hairs toward the middle of each margin; palea shorter than the lemma, not scarious, the keels minutely ciliate above; rudiment oblong-cuneate, truncate, 2 to 3 mm. long, the stipe about as long.

Type in the U. S. National Herbarium, no. 691233, collected in "Shaded places, Santa Eulalia Mountains, Chihuahua," Mexico, April 6, 1885, by C. G. Pringle (no. 430).

RANGE: Mountains of northern Mexico.

HERBARIUM SPECIMENS:

CHIHUAHUA: Santa Eulalia Mountains, shaded places, *Pringle* 430. Chihuahua, *Wilkinson* 342.

COAHUILA: Sierra Mojada Mountains, *Jones* 482. San Lorenzo Canyon, *Palmer* 551 in 1905.

**4. *Melica frutescens*** Scribn. Proc. Acad. Phila. **1885**: 45. *pl. 1. f. 15, 16*. 1886.

Type locality, "Southern California," the type specimen collected in the vicinity of San Diego by Parry and Lemmon (no. 401).

RANGE: Coast Ranges, southern California and Lower California.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Caysito, *Orcutt* 513. El Rancho Viejo, *Brandege* 15 in 1889. Near Tía Juana, *Jones* 3748.

**111. SENITES** Adans. Fam. Pl. **2**: 39, 604. 1763.

KEY TO THE SPECIES.

Blades oblong-lanceolate, over 10 cm. long.

Spikelets nodding on capillary pedicels; petiole densely villous..... 2. *S. capillaris*.

Spikelets erect on short pedicels; petiole glabrate or sparsely pubescent.

Panicle densely flowered, the branches ascending; blades mostly 5 to 6 cm. wide, lanceolate..... 1. *S. latifolia*.

Panicle loosely flowered, the branches spreading; blades narrower, oblong-lanceolate..... 1a. *S. latifolia pringlei*.

Blades ovate.

Blades about 10 cm. long, 7 to 8 cm. wide..... 3. *S. smilacifolia*.

Blades 2 to 4 cm. long.

Spikelets awned..... 4. *S. pringlei*.

Spikelets awnless..... 5. *S. mexicana*.

**1. *Senites latifolia*** (Fourn.).

*Krombholzia latifolia* Fourn. Bull. Soc. Bot. Belg. **15**: 463. 1876.

*Zeugites latifolia* Hemsl. Biol. Centr. Amer. Bot. **3**: 577. 1885.

*Zeugites pittleri* Hack. Oesterr. Bot. Zeitschr. **52**: 373. 1902.

Type locality, "Dolores," Oaxaca, the type specimen collected by Liebmann (no. 541).



RANGE: Pacific slope of southern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

JALISCO: Guadalajara, *Rose & Hay* 6277; cool slopes of barranca, *Pringle* 2046; under cliffs, barranca, *Pringle* 11249, 11765.

OAXACA: Dolores, *Liebmann* 541.

**1a. *Senites latifolia pringlei* (Hack.).**

*Zeugites pittieri* var. *pringlei* Hack. Oesterr. Bot. Zeitschr. **52**: 373. 1902.

Type locality, "Mexico: ad Guadalajara," the type specimen collected by Pringle (no. 2322).

RANGE: Southwestern Mexico.

HERBARIUM SPECIMENS:

JALISCO: Cool moist places, bluffs of Río Grande de Santiago near Guadalajara, *Pringle* 2322. Guadalajara, shady place by trail down Barranca de Oblatos, *Hitchcock* 7362.

GUERRERO: Canyon de la Mano Negra, near Iguala, *Rose, Painter & Rose* 9384. Iguala, canyon, *Pringle* 10386.

**2. *Senites capillaris* sp. nov.**

Perennial; culms erect, robust, 1.5 to 2 meters high, glabrous, sparingly branching from the upper nodes; sheaths villous on the margins, otherwise nearly glabrous, the lower loose, bladeless or with but a small triangular tip; ligule membranaceous, scarcely 1 mm. long; petiole 2 to 3 mm. long, densely villous; blades scabrous on both surfaces, 15 to 20 cm. long, 4 to 6 cm. wide, lanceolate or elliptic-lanceolate, tapering into an acuminate point; panicles loosely flowered, the slender branches spreading, few-flowered, the capillary pedicels recurved at the apex; spikelets nodding, about 7 mm. long, with 1 fertile and 3 or 4 sterile florets; glumes 5-nerved, not reticulate, unequal, dissimilar, the first 3 mm. long, oblanceolate or cuneate, subcucullate, rounded and entire at the apex, pubescent, the second attached about 0.5 mm. above the first, 2 mm. long, oblong, strongly gibbous, truncate and somewhat erose at apex, less pubescent than the first; fertile lemma about 3 mm. long, broadly ovate, gibbous, abruptly acute, about 11-nerved, scaberulous toward the tip, awnless; sterile lemmas 3 to 4 mm. long, narrower and more loosely arranged than in *S. latifolia*.

Type in the U. S. National Herbarium, no. 691234, collected in "Rich soil, wooded hillside, 450 meters altitude," Alzada, Colima, Mexico, September 21, 1910, by A. S. Hitchcock (no. 7073).

Known only from the type collection.

**3. *Senites smilacifolia* (Scribn.).**

*Zeugites smilacifolia* Scribn. Bot. Gaz. **21**: 134. 1896.

Type locality, "Faucibus, prope Cuernavaca, Morelos civitate," the type specimen collected by Pringle (no. 5961).

RANGE: Known only from the type locality.

HERBARIUM SPECIMENS:

MORELOS: Cuernavaca, wet barranca, *Pringle* 5961, 6604, 11251.

**4. *Senites pringlei* (Scribn.).**

*Zeugites pringlei* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. **11**: 50. pl. 6. 1898.

Type locality, "wet mountain canyons near Cuernavaca, State of Morelos, Mexico," the type specimen collected by Pringle (no. 7774).

RANGE: Mountains of Morelos.

HERBARIUM SPECIMENS:

MORELOS: Sierra de Tepoxtlán, under limestone cliffs, *Pringle* 8361, 11250, 13896. Cuernavaca, *Pringle* 7774.



**5. *Senites mexicana* (Kunth).***Despretzia mexicana* Kunth, Rév. Gram. 2: 485. pl. 157. 1831.*Zeugites mexicana* Trin.; Steud. Nom. Bot. ed. 2. 2: 798. 1841.

Type locality, Mexico, the type specimen collected by Schiede and Deppe, probably in Veracruz.

RANGE: Highlands of Central Mexico.

## HERBARIUM SPECIMENS :

SAN LUIS POTOSÍ: Las Canóas, rich woods, barranca, *Pringle* 3919.HIDALGO: Trinidad Iron Works, wet woodlands, *Pringle* 13252.VERACRUZ: Orizaba, *Botteri* in 1856. Zacuapan, *Purpus* 6222.**112. *ORTHOCLADA* Beauv. Ess. Agrost. 69. pl. 14. f. 9. 1812.****1. *Orthoclada rariflora* (Lam.) Beauv. Ess. Agrost. 69. 1812.***Panicum rariflorum* Lam. Encycl. 4: 746. 1798.

Type locality, "Cayenne."

RANGE: Southern Mexico and West Indies to Brazil.

## HERBARIUM SPECIMENS FROM MEXICO:

VERACRUZ: Sanborn, *Orcutt* 2932.OAXACA: Sierra San Pedro Nolasco, *Jurgensen* 953.TABASCO: San Sebastián, *Rovirosa* 420.**113. *STREPTOGYNE* Beauv. Ess. Agrost. 80. pl. 16. f. 8. 1812.****1. *Streptogyne crinita* Beauv. Ess. Agrost. 80. pl. 16. f. 8. 1812.**

Type locality erroneously given as "Etats-Unis d'Amérique, Carolina;" other specimens from "Guyana" mentioned.

RANGE: Veracruz to Brazil.

## HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Sanborn, *Orcutt* 2933.**114. *UNIOLA* L. Sp. Pl. 71. 1753.**

## KEY TO THE SPECIES.

Spikelets not strongly flattened; blades flat..... 1. *U. palmeri*.

Spikelets strongly flattened; blades involute.

Spikelets 5 mm. wide; panicle dense, erect..... 2. *U. pittieri*.Spikelets 1 cm. wide; panicle loose, nodding..... 3. *U. paniculata*.**1. *Uniola palmeri* Vasey, Gard. & For. 2: 401. f. 124. 1889.**

Type locality, "At the Horseshoe Bend of the Colorado River, thirty-five miles south of Lerdo by the river, and twelve to fifteen miles from its mouth," the type specimen collected by Palmer in 1889.

RANGE: Sands of northern Mexico.

## HERBARIUM SPECIMENS:

SONORA: Colorado River, below mouth of Hardy River, *Mearns* 2834. Thirty-five miles south of Lerdo, *Palmer* in 1889.DURANGO: Torreón, sandy flat along river, *Hitchcock* 7541.COAHUILA: Río Nazas, growing in sand, *Palmer* 507 in 1898.**2. *Uniola pittieri* Hack. Oesterr. Bot. Zeitschr. 52: 309. 1902.**

Type locality, "Costarica: in ora maritima Pacifica ad Baie de Salinas," the type specimen collected by Pittier.

RANGE: Pacific coast from Lower California to Costa Rica.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Without locality, *Dewey* in 1874.OAXACA: Puerto de Santa Cruz, *Liebmann* 539.



**3. Uniola paniculata** L. Sp. Pl. 71. 1753.

Type locality, "In Carolina."

RANGE: Atlantic coast, Virginia to South America.

HERBARIUM SPECIMEN FROM MEXICO:

TABASCO: Dos Bocas, *Rovirosa* 565.**115. DISTICHLIS** Raf. Journ. de Phys. 89: 104. 1819.**1. Distichlis spicata** (L.) Greene, Bull. Calif. Acad. 2: 415. 1887. SALT GRASS.*Uniola spicata* L. Sp. Pl. 71. 1753.

Type locality, "In Americae borealis maritimis."

RANGE: Salt marshes and alkaline soil throughout the United States and Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Cape St. Lucas, *Xantus* 120. Tecate River, near Monument no. 245, *Schoenfeldt* 3721; *Mearns* 3782. Seven Wells, Salton River, *Schoenfeldt* 2875. Playa María, *Anthony* 139. Nachognero Valley, *Mearns* 3361. Mulegé, *Palmer* 43 in 1887. Topo, *Orcutt* 1161. Santa Agueda, *Palmer* 219 in 1890. San Gregorio, *Brandeggee* 19 in 1889. Magdalena Island, *Brandeggee* 20 in 1889. Santa Catalina Mountains, *Orcutt* in 1884.

SONORA: Sonoyta River at Agua Dulce, *Mearns* 2787. Santa Ana, along track, *Hitchcock* 3626. Hermosillo, along ditch, *Hitchcock* 3624. San José de Guaymas, *Palmer* 270 in 1897.

CHIHUAHUA: Near Lake Santa María, *Nelson* 6416. Mesquite Springs, *Mearns* 266.

SINALOA: Altata, *Rose* 1367.

DURANGO: Durango, in large patches in alkaline bottoms, *Palmer* 182, 385, and 388 in 1896; along ditch, *Hitchcock* 7654.

COAHUILA: Jaral, *Schumann* 1739.JALISCO: Orozco, near large pond, *Hitchcock* 7384.HIDALGO: Pachuca, sandy soil along railway, *Hitchcock* 6761.

MÉXICO: Toluca, along road, *Hitchcock* 6921. Tlalnepantla, along railroad bank, *Rose, Painter & Rose* 8393. Without locality, *Galeotti* 5746. Federal District, along trolley line, *Hitchcock* 5874, 5875; cornfield, *Hitchcock* 5885; alkaline meadows, *Pringle* 6640; wet meadows, *Pringle* 9559; *Bourgeau* 230; *Rose & Hay* 5974; *Orcutt* 4110.

PUEBLA: Pico de Orizaba, *Liebmann* 481. Cerro Guadalupe, *Nicolas* in 1909. Tehuacán, old field, *Hitchcock* 6037; along ditch, *Hitchcock* 6041; along railway, *Hitchcock* 6046.

**116. BRIZA** L. Sp. Pl. 70. 1753.

## KEY TO THE SPECIES.

- Plants annual; panicle open..... 1. *B. minor*.  
Plants perennial; panicle compact..... 2. *B. rotundata*.

**1. Briza minor** L. Sp. Pl. 70. 1753.

Type locality given as "in Helvetia [et] Italia."

RANGE: Temperate regions of the Old World, sparingly introduced in North America.

HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Veracruz, *Purpus* 6204.**2. Briza rotundata** (H. B. K.) Steud. Syn. Pl. Glum. 1: 284. 1854.*Bromus rotundatus* H. B. K. Nov. Gen. & Sp. 1: 152. 1816.

Type locality, "In alta planitie Regni Mexicani, inter Zelaya et Queretaro."

RANGE: Highlands of eastern slope of Mexico.



## HERBARIUM SPECIMENS:

NUEVO LEÓN: Monterey, Sierra Madre, *Canby* 272; *Pringle* 2051.

SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 145; *Parry & Palmer* 935 in 1878; by irrigation ditch, *Hitchcock* 5677.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6738.

MÉXICO: Flor de María, calcareous bluffs, *Pringle* 3243. Amecameca, banks, *Purpus* 1615. Popo Park, edge of woods, *Hitchcock* 5968. Barranca above Santa Fé, *Pringle* 13627. Federal District, hills, *Pringle* 9558; edge of field, *Hitchcock* 5913; barranca of Río Aqueducto, *Rose & Painter* 8635.

PUEBLA: Esperanza, rocky hill, *Hitchcock* 6530. Cholula, *Nicolas* in 1910.

VERACRUZ: Consoquitla, *Liebmann* 477. Orizaba, *Bourgeau* 2790; open rocky hill, *Hitchcock* 6368. Jalapa, clay cut, *Hitchcock* 6599.

117. **ACHYRODES** Boehmer in Ludw. Def. Gen. Pl. 420. 1760.

1. **Achyrodes aureum** (L.) Kuntze, Rev. Gen. Pl. 2: 758. 1891. GOLDEN-TOP.

*Cynosurus aureus* L. Sp. Pl. 73. 1753.

*Lamarckia aurea* Moench, Meth. Pl. 201. 1794.

Type locality, southern Europe.

RANGE: Naturalized in southern California and Lower California.

HERBARIUM SPECIMEN FROM MEXICO:

LOWER CALIFORNIA: Ensenada, *Orcutt* 1428.

118. **POA** L. Sp. Pl. 67. 1753.

## BLUE GRASS.

## KEY TO THE SPECIES.

## Plants annual.

Panicle pyramidal, open; sheaths smooth..... 1. *P. annua*.

Panicle narrow, contracted; sheaths scabrous..... 2. *P. bigelovii*.

## Plants perennial.

Rhizomes present; lemmas cobwebby at base..... 3. *P. pratensis*.

Rhizomes absent.

Plants dwarf, alpine, only a few centimeters in height;  
blades obtuse, short..... 4. *P. villaroeli*.

Plants not dwarf, more than 20 cm. high.

Lemmas cobwebby at base.

Panicle narrow, almost spike-like..... 5. *P. conglomerata*.

Panicle loose, the branches slender and  
spreading.

Lemmas minutely scaberulous, not villous,  
except for the cobwebby hairs at  
base; panicle purple; spikelets 2 or  
3-flowered..... 6. *P. orizabensis*.

Lemmas villous on the lower part of the  
keel and marginal nerves; panicle  
green; spikelets 6 to 8-flowered..... 7. *P. ruprechtii*.

Lemmas not cobwebby at base.

Lemmas villous on the keel and marginal  
nerves..... 8. *P. fendleriana*.

Lemmas not villous.

Sheaths glabrous; lemmas glabrous except  
on the keel above..... 9. *P. albenscens*.



## Sheaths scabrous.

Panicle open, the lower branches  
spreading, naked below . . . . . 10. *P. strictiramea*.

Panicle narrow, the branches short,  
spikelet-bearing at base.

Lemmas smooth; spikelets 1 cm.  
long; blades firm, the  
uppermost reduced to a  
point . . . . . 11. *P. griffithsii*.

Lemmas scaberulous; spikelets 5  
to 8 mm. long; blades lax,  
the uppermost evident, 2  
cm. or more long . . . . . 12. *P. scabrella*.

1. *Poa annua* L. Sp. Pl. 68. 1753.

*Poa infirma* H. B. K. Nov. Gen. & Sp. 1: 158. 1816.

Type locality, "in Europa" [Sweden].

RANGE: Throughout the cold and temperate regions of the northern hemisphere.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, *Palmer* 28 in 1908.

DURANGO: San Ramón, *Palmer* 71 in 1906. Nombre de Dios, common along  
ditches in the town, *Palmer* 97 in 1896.

COAHUILA: Saltillo, *Palmer* 711 in 1905; wet irrigation ditch, *Hitchcock* 5601.

NUEVO LEÓN: Monterey, *Palmer* 1365 in 1880.

ZACATECAS: Plateado, *Rose* 2712. Zacatecas, along dry river bed, *Hitchcock* 7530.

SAN LUIS POTOSÍ: Alvarez, *Palmer* 173 in 1902. San Luis Potosí, park, *Hitch-*  
*cock* 5706. Cárdenas, along irrigation ditch, *Hitchcock* 5745.

JALISCO: Nevado de Colima, open ground, *Hitchcock* 7154. Guadalajara, *Palmer*  
483 in 1886.

QUERÉTARO: Querétaro, irrigation ditch, *Hitchcock* 5829.

HIDALGO: Pachuca, near small pond, *Hitchcock* 6747.

MÉXICO: Ixtaccihuatl, rocks above timber line, *Purpus* 1618. Popocatepetl,  
common in open places in woods up to near timber line, *Hitchcock* 5992; *Rose*  
& *Hay* 6246. Toluca, along ditch, *Hitchcock* 6913. El Oro, woods, *Pringle*  
9589. Federal District, along ditch in shade, *Hitchcock* 5929; *Holway* 3218.

PUEBLA: Chalchicomula, along road, *Hitchcock* 6280; field, *Hitchcock* 6292.  
Tehuacán, along ditch, *Hitchcock* 6049.

VERACRUZ: Boca del Monte, *Nelson* 219. Jalapa, along street, *Hitchcock* 6625.

MORELOS: El Parque, *Orcutt* 3858.

OAXACA: Oaxaca, wet soil, *Pringle* 4671.

2. *Poa bigelovii* Vasey & Scribn. in Vasey, Descr. Cat. Grasses U. S. 81. 1885.

Type locality, "Banks of the Rillita," Arizona, the type specimen collected by  
*Pringle*.

RANGE: Southwestern United States and northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: El Rancho Viejo, *Brandege* 24 in 1889.

CHIHUAHUA: Paso del Norte, *Vasey* in 1881.

COAHUILA: Saltillo, *Palmer* 532 in 1905.

NUEVO LEÓN: Sierra Madre above Monterey, *Pringle* 13748. Monterey, *Palmer*  
1365 in 1880.

3. *Poa pratensis* L. Sp. Pl. 67. 1753.

KENTUCKY BLUE GRASS.

Type locality, Sweden.

RANGE: Throughout temperate and colder parts of North America and Eurasia.



## HERBARIUM SPECIMEN FROM MEXICO:

VERACRUZ: Perote, *Nelson* 19.

4. *Poa villaroeli* Phil. Anal. Univ. Chile 94: 169. 1896.

Type locality, "Editoribus locis Andium provinciae Santiago," the type specimen collected by Villarroel.

RANGE: High mountains from southern Mexico to Chile.

## HERBARIUM SPECIMEN FROM MEXICO:

MEXICO: Ixtaccihuatl, alpine region, *Purpus* 3772.

5. *Poa conglomerata* Rupr.; Peyr. Linnaea 30: 8. 1859.

Type locality, "Pic de Orizaba," the type specimen collected by Galeotti (no. 5776).

RANGE: High mountains of southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

MÉXICO: Popocatepetl, rather moist place in woods, along road, *Hitchcock* 5982; open place along trail, *Hitchcock* 5998; *Rose & Hay* 6026a. Ixtaccihuatl, rocky soil above timber line, *Purpus* 1638; rocky soil, subalpine region, *Purpus* 1644. Sierra de las Cruces, under dry cool cliffs, *Pringle* 4307.

PUEBLA: Mount Orizaba, *Seaton* 190; *Nelson* 287; *Pringle* 9594; wet sunny spots near timber line, *Purpus* 2887; sandy soil, timber line, *Purpus* 2888; *Rose & Hay* 5732; *Hitchcock* 6251.

6. *Poa orizabensis* sp. nov.

Perennial; culms cespitose, not producing rhizomes, 40 to 60 cm. high, spreading, 1-noded, glabrous; sheaths compressed, minutely scabrous; ligule of the innovations very short, of the culm leaves about 2 mm. long; blades firm, folded, nerved, scabrous above and on the margins, nearly smooth beneath, 2 to 4 mm. wide, 5 to 15 cm. long, the upper culm blade 1.5 to 2 cm. long; panicle open, about 10 cm. long, the slender branches in 1's or 2's, spreading or drooping, scabrous, naked below, spikelet-bearing along the upper half; spikelets short-pedicelled, purple, ovate, about 4 mm. long, 2 or 3-flowered; glumes nearly equal, 2.5 mm. long, smooth, scabrous on the keel above; lemmas oblong, cobwebby at base, somewhat villous on the keel below, 5-nerved or the lower obscurely 7-nerved, minutely scaberulous, especially on the nerves, scarious at the tip, the lower 3 mm. long.

Type in the U. S. National Herbarium, no. 691227 collected on "Bald hill, 3,940 meters altitude, Mt. Orizaba," Mexico, August 17, 1910, by A. S. Hitchcock (no. 6254).

RANGE: High mountains of southern Mexico.

## HERBARIUM SPECIMENS:

MÉXICO: Popocatepetl, open mountain side, *Hitchcock* 6004; at timber line, rare, *Hitchcock* 5988.

PUEBLA: Mount Orizaba, *Hitchcock* 6254.

7. *Poa ruprechtii* Peyr. Linnaea 30: 6. 1859.

Type locality, "Toluca, Cocustepec," the type specimen collected by Heller (no. 312).

RANGE: Mountains of Mexico.

## HERBARIUM SPECIMENS:

COAHUILA: Mountains east of Saltillo, *Palmer* 1366 in 1880.

NUEVO LEÓN: Sierra Madre above Monterey, calcareous ledges, *Pringle* 10212.

8. *Poa fendleriana* (Steud.) Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13: pl. 74. 1893.

*Eragrostis fendleriana* Steud. Syn. Pl. Glum. 1: 278. 1854.

Type locality erroneously given as "Mexico," the type specimen collected in New Mexico by Fendler (no. 932).

RANGE: Wyoming to Washington and south into northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Hansen's ranch, *Orcutt* 1276, 1276a.



**9. *Poa albescens* sp. nov.**

Perennial, the whole plant whitish; culms erect, cespitose, 20 to 30 cm. high, slightly scabrous below the panicle; sheaths glabrous, longer than the internodes, the old basal ones persistent, numerous, papery; ligule very short, the uppermost about 1 mm., those of the innovations scarcely 0.5 mm. long; blades mostly basal and on the innovations, firm, folded, glabrous beneath, scabrous above and on the margin, sharp-pointed, the primary 10 to 20 cm. long, 2 mm. wide, those of the innovations shorter, the uppermost cauline blades a few millimeters long or reduced to a point; panicles narrow, oblong, rather dense, about 5 cm. long, the axis glabrous, the branches scabrous, ascending, flower-bearing nearly from base, the ultimate lateral pedicels very short (less than 1 mm. long); spikelets about 4-flowered, ovate or elliptical, flattened, about 6 mm. long, 3 mm. wide; glumes nearly equal, nearly as long as the spikelet, glabrous, acuminate, the first 1-nerved, the second 3-nerved; lemmas oblong, firm, acute, glabrous, slightly scabrous at tip of keel, obscurely 5-nerved.

Type in the U. S. National Herbarium, no. 454361, collected at Miñaca, Chihuahua, April 1, 1908, by J. N. Rose (no. 11648).

No other specimens have been observed. This species is allied to *Poa chilensis* Trin.<sup>1</sup> (not Moris<sup>2</sup>), as represented by two specimens in the U. S. National Herbarium, one from Chile, distributed by Dr. R. A. Philippi, and one from the province of San Juan, Argentina (Kurtz no. 9666). These differ in having longer ligules and abruptly acute blades.

**10. *Poa strictiramea* sp. nov.**

Perennial; culms cespitose, 30 to 40 cm. high, erect, about 3-noded, glabrous; sheaths scabrous; ligule 2 mm. long; blades erect, flat or folded, scabrous, 1 to 2 mm. wide, those of the innovations 15 to 20 cm. long, those of the culm shorter; panicle not much exserted, open, about 10 cm. long, the branches mostly in pairs, slender, ascending, the lower stiff, 5 to 6 cm. long, spikelet-bearing toward the ends; spikelets tawny, lanceolate, short-pedicelled, 3 to 5-flowered, 5 to 6 mm. long; glumes unequal, acute, glabrous, scabrous on the keel, the lower 2.5 mm. long, the upper broader, 3.5 mm. long; lemmas acuminate, faintly nerved, scaberulous all over the back, not cobwebby, the lowermost about 4 mm. long.

Type in the U. S. National Herbarium, no. 820909, collected on "cool ledges of La Bufa Mountain above Cusihuiriachic, Chihuahua," Mexico, September 2, 1887, by C. G. Pringle (no. 1437).

Known only from the type collection.

**11. *Poa griffithsii* sp. nov.**

Perennial; culms cespitose, not producing rhizomes, 50 to 60 cm. high, erect, 1-noded, scabrous; sheaths scabrous; ligule about 0.5 mm. long; blades firm, pungently pointed, flat or folded, scabrous above, glabrous beneath, 1 to 2 mm. wide, those of the innovations 15 to 20 cm. long, the lower blades of the culm about 5 cm. long, the upper mostly reduced to a mere point; panicles long-exserted, narrow, 6 to 10 cm. long, the branches short, appressed, spikelet-bearing from near the base; spikelets pale green or tawny, nearly sessile, lanceolate, about 1 cm. long, 3 to 4 mm. wide, about 8-flowered, the florets closely imbricated; glumes acute, about 5 mm. long, glabrous, a few serrations on the keel above; lemmas firm, smooth, slightly serrate on the upper part of the keel, the nerves indistinct, no cobwebby hairs at the base; palea shorter than the lemma, ciliate-scabrous on the keels.

Type in the U. S. National Herbarium, no. 691228, collected at Cananea, Sonora, July 7-8, 1903, by David Griffiths (no. 4865).

RANGE: Known only from the type collection.

<sup>1</sup> Mém. Acad. St. Pétersb. VI. Sci. Nat. 2<sup>1</sup>: 62. 1836.

<sup>2</sup> Ann. Stor. Nat. Bologna 4: 60. 1830.



**12. *Poa scabrella* (Thurb.) Benth.; Vasey, Grasses U. S. 42. 1883.***Atropis scabrella* Thurb. in S. Wats. Bot. Calif. 2: 310. 1880.*Poa orcuttiana* Vasey, West. Amer. Sci. 3: 165. 1887.

Type locality, Oakland, California, the type specimen collected by Bolander.

RANGE: Pacific slope, Oregon to Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Near Vallecito, *Orcutt* 1440. Todos Santos Bay, *Fish* 28, 30. Guadalupe Canyon, *Orcutt* 1269b. Guadalupe Ranch, *Orcutt* in 1886. Carisito, *Orcutt* in 1885. Cantillas Mountains, *Orcutt* 1148.

**119. *GRAPHEPHORUM* Desv. Nouv. Bull. Soc. Philom. Paris 2: 189. 1810.**

## KEY TO THE SPECIES.

Panicle narrow, contracted ..... 1. *G. altijugum*.Panicle open, the branches spreading ..... 2. *G. pringlei*.**1. *Graphephorum altijugum* Fourn. Mex. Pl. 2: 111. 1886.***Trisetum altijugum* (Fourn.) Scribn. Rhodora 8: 89. 1906.

Type locality, "In monte Orizabensi," the type specimen collected by Liebmann (no. 603).

It is probable that this species and also *G. pringlei* should be referred to *Trisetum*, but the present disposition is retained until the allied species can be given further study.

RANGE: High mountains of southern Mexico.

## HERBARIUM SPECIMENS:

MÉXICO: Popocatepetl, rather moist places in woods, *Hitchcock* 5982½; woods, *Hitchcock* 5997; open woods, *Hitchcock* 6013. Sierra de las Cruces, dry ledges under firs, *Pringle* 4306. Tres Marias, *Orcutt* 3740.

OAXACA: Sierra de San Felipe, *Pringle* 4775, *Smith* 941.**2. *Graphephorum pringlei* Scribn.; Beal, Grasses N. Amer. 2: 561. 1896.**

Type locality, "Mexico, \* \* \* Summit of Sierra San Felipe," the type specimen collected by Pringle (no. 4765).

RANGE: Known only from the type locality.

## HERBARIUM SPECIMENS:

OAXACA: Sierra de San Felipe, summit, *Pringle* 4765; *Nelson* 1108.**120. *PANICULARIA* Fabr. Enum. Pl. Hort. Helmst. 2: 373. 1763.****1. *Panicularia nervata* (Willd.) Kuntze, Rev. Gen. Pl. 2: 783. 1891.***Poa nervata* Willd. Sp. Pl. 1: 389. 1797.

Type locality, "in America boreali."

RANGE: British America to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Collected in the Sierra Madre near Colonia García, in wet ground, *Townsend & Barber* 112.

HIDALGO: Under spray of a waterfall, barranca below Trinidad Iron Works, *Pringle* 8870.

**121. *FESTUCA* L. Sp. Pl. 73. 1753.**

## FESCUE GRASS.

## KEY TO THE SPECIES.

Plants annual.

Lemmas ciliate ..... 4. *F. megalura*.

Lemmas not ciliate.



- Glumes strongly unequal, the lower not more than one-third as long as the second..... 3. *F. myuros*.
- Glumes but slightly unequal.
- Main panicle branches divergent..... 2. *F. pacifica*.
- Main panicle branches appressed.
- Lemmas smooth or scabrous..... 1. *F. octoflora*.
- Lemmas hirtellous..... 1a. *F. octoflora hirtella*.
- Plants perennial.
- Plants loosely tufted, the slender culms decumbent at base; blades narrow, folded or involute, smooth or nearly so..... 5. *F. rubra glaucodea*.
- Plants densely tufted.
- Blades flat, coarse; culms 1 meter high or more... 11. *F. amplissima*.
- Blades folded or involute, or sometimes with flat blades intermixed.
- Blades smooth.
- Plants not in cushions; culms usually over 40 cm. high, the open panicles much exceeding the leaves; spikelets 8 to 10 mm. long, the glumes about 4 mm. long..... 10. *F. willdenoviana*.
- Plants in dense cushions; culms 10 to 20 cm. high, the short panicles not much exceeding the leaves; spikelets few, pendulous, 10 to 14 mm. long, the glumes 10 to 13 mm. long. 13. *F. livida*.
- Blades scabrous.
- Plants tall and coarse; blades scattered; lemmas distinctly awned.
- First glume 4 to 5 mm., second 5 to 6 mm. long; lemma scaberulous.. 8. *F. tolucensis*.
- First glume 7 to 8 mm., second 8 to 9 mm. long, both of them narrow and long-acuminate; lemma strongly scabrous..... 12. *F. mirabilis*.
- Plants lower and more delicate; blades mostly basal; lemmas awnless or mucronate (or short-awned in no. 7).
- First glume 5 mm. long; blades of innovations very slender, 0.5 mm. wide, 30 cm. or more long..... 9. *F. rosei*.
- First glume 3 to 4 mm. long.
- Lower panicle branches short, appressed; blades of innovations mostly less than 10 cm. long; lemmas often short-awned..... 7. *F. hephaestophila*.
- Lower panicle branches spreading, naked below; lemmas not awned.
- Blades all involute, capillary..... 6a. *F. ovina callosa*.
- Blades partly flat, these 2 to 5 mm. wide..... 6. *F. ovina elliptica*.



**1. *Festuca octoflora* Walt. Fl. Carol. 81. 1788.**

Type locality, presumably South Carolina.

RANGE: Quebec to British Columbia, southward, on the Pacific slope, extending into Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: La Chuparosa, *Brandeggee* 61 in 1893. San Martín Island, *Anthony* 214. Hansen's ranch, *Orcutt* 1142. San Quentín Bay, *Palmer* 684 in 1889. Guadalupe Ranch, *Orcutt* 1432 in part. Todos Santos Island, *Anthony* 195.

**1a. *Festuca octoflora hirtella* Piper, Contr. U. S. Nat. Herb. 10: 12. 1906.**

Type locality, "Santa Catalina Mountains, Arizona," the type specimen collected by Shear (no. 1962).

RANGE: Southwestern United States and Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Lagoon Head, *Palmer* 655 in 1889. San Quentín Bay, *Palmer* 683 in 1889. Guadalupe Island, *Palmer* 657 and 674 in 1889. Guadalupe Ranch, *Orcutt* 1432. Near Mission, Santa Gertrudis, *Orcutt* in 1899.

**2. *Festuca pacifica* Piper, Contr. U. S. Nat. Herb. 10: 12. 1906.**

Type locality, "Pullman, Washington," the type specimen collected by Elmer (no. 262).

RANGE: Pacific slope, British Columbia to Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandeggee* 2 in 1890. Guadalupe Ranch, *Orcutt* in 1886.

**3. *Festuca myuros* L. Sp. Pl. 74. 1753.**

Type locality, given as "In Anglia, Italia."

RANGE: Introduced in the United States and south to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6732; near small pond, *Hitchcock* 6746; sandy river bed, *Hitchcock* 6755.

MÉXICO: Toluca, rocky hill, *Hitchcock* 6899; *Rose & Painter* 6786. Popo Park, edge of woods, *Hitchcock* 5969; open ground, *Hitchcock* 6026. Salto de Agua, dry sunny hills, *Purpus* 1642. Ixtaccihuatl, foothills, *Deam* 22; rocks above timber line, *Purpus* 1641. Amecameca, *Deam* in 1899. Parras, *Orcutt* 3804.

MORELOS: El Parque, *Orcutt* 3860.

**4. *Festuca megalura* Nutt. Journ. Acad. Phila. II. 1: 188. 1848.**

Type locality, "Santa Barbara, Upper California," the type specimen collected by Gambel.

RANGE: Pacific slope, British Columbia to Chile.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Nachognero Valley, *Schoenfeldt* 3442. Guadalupe Island, *Palmer* 672 in 1889.

**5. *Festuca rubra glaucodea* Piper, Contr. U. S. Nat. Herb. 10: 22. 1906.**

*Festuca glaucescens* Hegetschw. & Heer, Fl. Schweiz. 93. 1840, not Roth, 1821.

Type locality, Switzerland.

RANGE: The species and its varieties ranging throughout northern Europe and North America, only this form found in northern Mexico.

## HERBARIUM SPECIMEN FROM MEXICO:

CHIHUAHUA: Sierra Madre near Colonia García, canyon, *Townsend & Barber* 114.

**6. *Festuca ovina elliptica* (Beal) Piper, Contr. U. S. Nat. Herb. 10: 43. 1906.**

*Festuca amplissima elliptica* Beal, Grasses N. Amer. 2: 603. 1896.



Type locality, "Mexico (Chihuahua)," the type specimen collected by Pringle (no. 1438).

RANGE: Mountains of Chihuahua and Durango.

HERBARIUM SPECIMENS:

CHIHUAHUA: Sierra Madre, moist canyons, *Pringle* 1438.

DURANGO: Durango, *Rose* 2358.

6a. *Festuca ovina callosa* Piper, subsp. nov.

Densely tufted, the 2 or 3-jointed culms 50 to 70 cm. long, much exceeding the leaves, the persistent sheaths of the latter becoming explanate; blades filiform, pale green, minutely scaberulous but nearly smooth to the touch, closely involute, 12 to 20 cm. long, much longer than the sheaths, bearing on each side at the junction of the sheath a prominent callosity; ligule short; panicle narrow, 8 to 12 cm. long, the short slender rays in 2's; spikelets ovate-oblong, purplish, glaucous, 5 or 6-flowered, 7 to 12 mm. long; lemma acute, not awned; palea bidentate.

Type in U. S. National Herbarium, no. 691783, collected on a rocky hill at 2,500 meters altitude, Esperanza, Puebla, Mexico, August 28, 1910, by A. S. Hitchcock (no. 6490).

In bearing callosities at the base of the leaf blades this plant resembles *Festuca ovina calligera* Piper and in its explanate leaf sheaths, *F. ovina arizonica* (Vasey) Hack., but in other characters it is quite distinct from either.

RANGE: Known only from the type locality, a second specimen, Hitchcock no. 6472, having been collected at the same place.

7. *Festuca hephaestophila* Nees in Steud. Syn. Pl. Glum. 1: 310. 1854.

Type locality, "In cratere montis ignivomi: Volcan de Agua Mexico."

RANGE: High mountains of southern Mexico.

HERBARIUM SPECIMENS:

MÉXICO: Nevado de Toluca, bottom of crater, *Pringle* 4221. Ixtaccihuatl, rocky soil, *Purpus* 228. Cima, *Orcutt* 3775.

PUEBLA: Mount Orizaba, *Rose & Hay* 5768; rocky slopes, alpine region, *Purpus* 3015; *Liebmann* 509; *Ross* 1272, 1283; *Pringle* 8588; bald hills, *Hitchcock* 6255; bunches in open ground, *Hitchcock* 6260; *Rose & Hay* 5774. Santa Bárbara, *Nicolas* in 1910.

8. *Festuca tolucensis* H. B. K. Nov. Gen. & Sp. 1: 153. 1816.

Type locality, "in montosis, scopulosis, apricis regni Mexicani, inter Islahuaca et Toluca."

RANGE: Mountains of Mexico.

HERBARIUM SPECIMENS:

CHIHUAHUA: Mount Mohinora, *Nelson* 4900.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 924 in 1878.

JALISCO: Nevado de Colima, pine woods, the dominant grass above timber line, *Hitchcock* 7158; above timber line, at its maximum development, *Hitchcock* 7167; at summit, *Hitchcock* 7165½; *Ross* 498.

MÉXICO: Popocatepetl, *Rose & Hay* 5978a, 6297; overhanging bank, open ground, *Hitchcock* 6001. Tres Mariás, *Orcutt* 3743, 3748. Nevado de Toluca, *Rose & Painter* 7983; *Nelson* 14. Cima, *Orcutt* 3773.

PUEBLA: Mount Orizaba, open pine woods, *Hitchcock* 6256; large bunches, *Hitchcock* 6267; *Seaton* 193; sandy plains, *Seaton* 228; *Rose & Hay* 5697, 5735; *Liebmann* 510, 511; alpine region, *Ross* 1276.

9. *Festuca rosei* Piper, Contr. U. S. Nat. Herb. 10: 45. 1906.

Type locality, "near Cima, State of Mexico," the type specimen collected by *Rose & Painter* (no. 7210).

RANGE: Known only from the type collection.



**10. *Festuca willdenoviana* Schult. Mant. 2: 650. 1824.**

Type locality, "Mexico."

RANGE: High mountains of southern Mexico.

## HERBARIUM SPECIMENS:

MÉXICO: Popocatepetl, open woods, *Hitchcock* 5984, 5999, 6012. Sierra de las Cruces, dry banks, *Pringle* 4484.PUEBLA: Mount Orizaba, *Rose & Hay* 5743, 6349.**11. *Festuca amplissima* Rupr. Bull. Acad. Sci. Brux. 9<sup>2</sup>: 236. 1842 (description insufficient); Fourn. Mex. Pl. 2: 125. 1886.**

Type locality, "pres de la Vaqueria del Jacal," Mount Orizaba, the type specimen collected by Galeotti (no. 5766).

RANGE: High mountains of southern Mexico.

## HERBARIUM SPECIMENS.

HIDALGO: Sierra de Pachuca, *Rose, Painter & Rose* 8776.MICHUACÁN: Pátzcuaro, mountains, *Pringle* 3945.MÉXICO: Ixtaccihuatl, rocks, *Purpus* 1639. Popocatepetl, common, open woods, *Hitchcock* 5979; *Rose & Hay* 6262. Federal District, *Pringle* 9555; *Bourgeau* 1307; *Rose & Hay*, 5515.PUEBLA: Mount Orizaba, large bunches, open woods, *Hitchcock* 6263; *Liebmann* 506, 508. Sierra de San Felipe, *Smith* 924.OAXACA: Mount Zempoaltepec, side of summit, *Nelson* 648.**12. *Festuca mirabilis* Piper, Contr. U. S. Nat. Herb. 10: 47. 1906.**

Type locality, "Alvarez, about 2,700 meters altitude, State of San Luis Potosí," the type specimen collected by Palmer in 1904.

RANGE: Mountains of Mexico.

## HERBARIUM SPECIMENS:

CHIHUAHUA: Sánchez, rocky pine woods, *Hitchcock* 7683.SAN LUIS POTOSÍ: Alvarez, *Palmer* 164 in 1904.HIDALGO: Pachuca, rocky hill, *Hitchcock* 6731.MÉXICO: Cima, *Rose & Painter* 7208.**13. *Festuca livida* (H. B. K.) Willd.; Spreng. Syst. Veg. 1: 353. 1825.***Bromus lividus* H. B. K. Nov. Gen. & Sp. 1: 150. 1816.

Type locality, "in alta planitie Tolucana."

RANGE: High mountains of southern Mexico.

## HERBARIUM SPECIMENS:

MÉXICO: Nevado de Toluca, in the crater, *Pringle* 4304; *Rose & Painter* 8017; *Nelson* 3. Popocatepetl, *Rose & Hay* 5978; black sand barrens, *Hitchcock* 5986. Ixtaccihuatl, *Purpus* 27; gravelly soil of glaciers, *Purpus* 1614.PUEBLA: Mount Orizaba, common between snow and timber lines, *Hitchcock* 6257; *Liebmann* 615; *Smith* 598.VERACRUZ: Perote, *Nelson* 45.**122. BROMUS L. Sp. Pl. 76. 1753.**

## BROME GRASS.

## KEY TO THE SPECIES.

Awn bent, somewhat twisted, from between the acuminate teeth of the lemma..... 1. *B. trini*.

Awn straight.

Spikelets strongly compressed-keeled.

Plants annual..... 7. *B. carinatus*.



## Plants perennial.

Lemmas glabrous or scabrous..... 5. *B. pendulinus*.Lemmas villous on the margins..... 6. *B. exaltatus*.

## Spikelets not strongly compressed-keeled.

Lemmas scabrous..... 2. *B. texensis*.

## Lemmas villous.

Lemmas villous all over..... 3. *B. porteri*.Lemmas villous on the margin..... 4. *B. richardsoni*.1. *Bromus trinii* Desv. in Gay, Fl. Chil. 6: 441. 1853.

Type locality, "Andes de Chile austral."

RANGE: Mexico to Chile, introduced in California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Near Vallecito, *Orcutt* in 1886. Guadalupe Ranch, *Orcutt* in 1886. Guadalupe Island. *Palmer* 658 and 667 in 1889. Cedros Island, *Palmer* 659 in 1889. San Quentín Bay, *Palmer* 686 in 1889.

2. *Bromus texensis* (Shear).*Bromus purgans texensis* Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 41. 1900.

Type locality, "Bexar County, Texas," the type specimen collected by Jermy (no. 230).

RANGE: Texas and northeastern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

NUEVO LEÓN: Sierra Madre near Monterey, *Pringle* 2652.3. *Bromus porteri* (Coulter) Nash, Bull. Torrey Club 22: 512. 1895.*Bromus kalmii porteri* Coulter, Man. Rocky Mount. 425. 1885.

Type locality, "Colorado, at Twin Lakes," the type specimen collected by Porter.

RANGE: Manitoba to Alberta, south to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: La Chuparosa, *Brandege* 73 in 1893, 27 in 1899.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* in 1885. Sánchez, rocky pine woods, *Hitchcock* 7665. Sierra Madre near Colonia García, *Townsend & Barber* 327.

ZACATECAS: Sierra de Los Morones near Plateado, *Rose* 2727.SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 129.JALISCO: Zapotlán, pine woods, hillside, *Hitchcock* 7241.

HIDALGO: Pachuca, rocky hill, *Hitchcock* 6741. Tula, along railroad, *Rose, Painter & Rose* 8357.

MÉXICO: Popocatepetl, open woods, *Hitchcock* 6011. Toluca, *Rose & Painter* 6796, rocky hill, among maguey plants, *Hitchcock* 6895.

TLAXCALA: Contadero Station, hills, *Pringle* 8597.

PUEBLA: Mount Orizaba, open woods, *Hitchcock* 6264. Esperanza, barren hills, *Pittier* 424; rocky hill, *Hitchcock* 6484. San Marcos, railway embankment, *Hitchcock* 6516. San Luis Tultitlanapa, Cerro de Paxtle, moist soil, *Purpus* 2898; Chalchicomula, ravine in rocky hill, *Hitchcock* 6277.

OAXACA: Sierra de San Felipe, *Pringle* 4898, *Smith* 942.4. *Bromus richardsoni* Link, Hort. Berol. 2: 281. 1833.

Type locality, "in America septentrionali occidentali," the source of seed from which the type specimen was grown.

RANGE: Rocky Mountains, British America to central Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, rocky ravine, *Hitchcock* 7708, 7713.PUEBLA: Puebla, *Nicolas* in 1908.



**5. *Bromus pendulinus* Sessé in Lag. Gen. & Sp. Nov. 4. 1816.***Bromus laciniatus* Beal, Grasses N. Amer. 2: 615. 1896.*Bromus proximus* Shear, Bull. Torrey Club 28: 245. 1901.

Type locality, Mexico, whence seed was sent by Sessé to Madrid.

RANGE: Highlands of Mexico and Central America.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, rocky ravine, *Hitchcock* 7704, 7718; along railway, *Hitchcock* 7719. Southwestern Chihuahua, *Palmer* in 1885.DURANGO: Durango, edge of a wheat field in bottom land, *Palmer* 171 and 171a in 1896; among willows, bank of pond, *Palmer* 734 in 1896; among bushes by pond, *Hitchcock* 7569. Otinapa, *Palmer* 346 in 1906.COAHUILA: Saltillo, canyon and elevated portion of Sierra Madre, *Palmer* 1372, in 1880; *Arsène* in 1909; irrigation ditch, *Hitchcock* 5584, 5594; cultivated ground, *Palmer* 5 and 266 in 1898.TEPIC: Sierra Madre, near Santa Teresa, *Rose* 2138.ZACATECAS: Zacatecas, in gulch in dry sterile hills, *Hitchcock* 7505.SAN LUIS POTOSÍ: Cárdenas, irrigated field, *Hitchcock* 5744. San Luis Potosí, alfalfa field, *Hitchcock* 5667, 5711. Alvarez, *Palmer* 171 in 1904.GUANAJUATO: Obregón, along railway, *Hitchcock* 5800. Acámbaro, along road, *Hitchcock* 6947.QUERÉTARO: Querétaro, edge of field, *Hitchcock* 5819.HIDALGO: Between Somoriel and Las Lajas, *Rose, Painter & Rose* 9203. Ixmiquilpan, river banks, *Rose, Painter & Rose* 9061, limestone hillside, *Rose, Painter & Rose* 8998. Between Pachuca and Real del Monte, in oak woods, *Rose, Painter & Rose* 8683. Pachuca, *Rose & Painter* 6750; rocky hill, *Hitchcock* 6745. Tula, along railroad, *Rose, Painter & Rose* 8358.MÉXICO: Popocatepetl, woods, *Hitchcock* 5993; open places, *Hitchcock* 5994. Popo Park, along stream, *Hitchcock* 5964. Lechería, fields, *Pringle* 13243. Toluca, rocky hill, *Hitchcock* 6907. San Angel, rocky banks of stream, *Rose, Painter & Rose* 9481. Federal District, lava field, *Hitchcock* 5949; *Orcutt* 3722; along trolley, *Hitchcock* 5872; along ditch, *Hitchcock* 5921; *Holway* 3034; *Bourgeau* 220; *Pringle* 9601.TLAXCALA: Contadero, *Rose & Hay* 5966.PUEBLA: Chinantla, *Liebmann* 483, Teziutlán, *Orcutt* 4037. Chalchicomula, waste ground, *Hitchcock* 6269, 6290. San Marcos, railway embankment, *Hitchcock* 6517, 6537. Mount Orizaba, near timber line, *Hitchcock* 6250. Esperanza, rocky hill, *Hitchcock* 6495; along railway, *Hitchcock* 6497. Rancho Posados, *Nicolas* in 1909. Puebla, talus, *Nicolas* in 1909. Tehuacán, along ditch, *Hitchcock* 6043.VERACRUZ: Orizaba, *Botteri* 726; roadside ditch, *Hitchcock* 6332. Jalapa, by railway track, *Hitchcock* 6592.MORELOS: Cuernavaca, along street, *Hitchcock* 6885.OAXACA: Sierra de San Felipe, *Pringle* 4897.CHIAPAS: San Cristóbal, *Nelson* 3172.**6. *Bromus exaltatus* Bernh. in Linnaea 15: Litt. 90. 1841.**

Type locality, "in regno Mexicano."

RANGE: Mountains of southern Mexico.

## HERBARIUM SPECIMENS:

JALISCO: Nevado de Colima, in timber, *Hitchcock* 7152.MÉXICO: Popocatepetl, open woods, hillside, *Hitchcock* 5985.OAXACA: Sierra de San Felipe, *Smith* 925.PUEBLA: Mount Orizaba, *Rose & Hay* 5733. Vaquería del Jacal, *Liebmann* 488.



**7. *Bromus carinatus* Hook. & Arn. Bot. Beechey Voy. Suppl. 403. 1841.**

Type locality, California.

RANGE: Pacific slope, Washington to Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Guadalupe Ranch, *Orcutt* in 1886. Nachognero Valley, *Schoenfeldt* 3444, *Mearns* 3481. San Julio Canyon, *Brandeggee* 17 in 1889. Potrero Valley, *Orcutt* in 1889. Todos Santos Bay, *Fish* in 1882.

**123. *BRACHYPODIUM* Beauv. Ess. Agrost. 100, 155. pl. 19. f. 3. 1812.**

## KEY TO THE SPECIES.

- Lemmas awnless..... 1. *B. pringlei*.  
 Lemmas awned..... 2. *B. mexicanum*.

**1. *Brachypodium pringlei* Scribn.; Beal, Grasses N. Amer. 2: 627. 1896.**

Type locality, "Mexico \* \* \* moist banks [in the Sierra Madre] near Monterey," the type specimen collected by Pringle (no. 2525).

RANGE: Known only from the type collection.

**2. *Brachypodium mexicanum* (Roem. & Schult.) Link, Hort. Berol. 1: 41. 1833.***Festuca mexicana* Roem. & Schult. Syst. Veg. 2: 732. 1817.

Type locality, "in Imperio Mexicano."

RANGE: Highlands of Mexico to Colombia.

## HERBARIUM SPECIMENS:

LOWER CALIFORNIA: Sierra de la Laguna, *Brandeggee* in 1899.SAN LUIS POTOSÍ: San Luis Potosí, *Schaffner* 128. Alvarez, *Palmer* 166 in 1904.JALISCO: Nevado de Colima, in timber, *Hitchcock* 7148. Ravines of mountains near Lake Chapala, *Pringle* 6198.HIDALGO: Pachuca, rocky hill, open ground, *Hitchcock* 6703; among shrubs, rocky Hill, *Hitchcock* 6719, 6739.MICHOCÁN: Pátzcuaro, mountains, *Pringle* in 1891.

MÉXICO: Tres Marías, *Orcutt* 3738. Popo Park, shady mossy bank, *Hitchcock* 5962, 5967. Sierra de las Cruces, *Pringle* 4231. Popocatepetl, bank of deep cut, *Hitchcock* 5977; shady bank, *Hitchcock* 6007, 6008. Iztaccihuatl, sunny hill-sides, *Purpus* 1640. Toluca, rocky hill, *Hitchcock* 6900. Federal District, shady rich moist soil, *Hitchcock* 5930; *Pringle* 9607.

PUEBLA: Teziutlán, *Orcutt* 4005. Chalchicomula, rocky hill, *Hitchcock* 6284. Chinantla, *Liebmann* 556. Mount Orizaba, *Liebmann* 562. Esperanza, along railway, *Hitchcock* 6504; barren hills, *Pittier* 421.

OAXACA: Cumbre de Estepec, *Liebmann* 558.**124. *LOLIUM* L. Sp. Pl. 83. 1753.**

## RYE GRASS.

## KEY TO THE SPECIES.

- Spikelets awnless..... 1. *L. perenne*.  
 Spikelets awned..... 2. *L. multiflorum*.

**1. *Lolium perenne* L. Sp. Pl. 83. 1753.**

Type locality, "in Europa."

RANGE: Introduced from Europe in the United States, adventive in Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

SONORA: Guaymas, *Palmer* 52 in 1887.**2. *Lolium multiflorum* Lam. Fl. Franç. 3: 621. 1778.**

Type locality, "environs de Péronne," France.



RANGE: Introduced in the United States, adventive in Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

MÉXICO: Popo Park, escaped, along road, *Hitchcock* 6022.

PUEBLA: Near Puebla, waste ground, *Arsène* in 1907.

125. **JOUEVA** Fourn. Bull. Soc. Bot. Belg. 15: 475. 1876.

KEY TO THE SPECIES.

Blades mostly flat, rather lax; culms slender, erect; pistillate spike slender, 1 mm. in diameter..... 1. *J. straminea*.

Blades folded, thick and firm, pungently pointed; culms spreading; pistillate spike conical, about 4 mm. in diameter at base.... 2. *J. pilosa*.

1. **Jouvea straminea** Fourn. Bull. Soc. Bot. Belg. 15: 475. 1876.

Type locality, "In arena littorali maris Pacifici prope San Angustin," the type specimen collected by Liebmann.

RANGE: Pacific coast of southern Mexico and Central America.

HERBARIUM SPECIMENS FROM MEXICO:

GUERRERO: Acapulco, *Palmer* 443 in 1895.

OAXACA: Playa de San Angustín, sandy shore of Pacific Ocean, *Liebmann* 738.

2. **Jouvea pilosa** (Presl) Scribn. Bull. Torrey Club 23: 143. 1896.

*Brizopyrum pilosum* Presl, Rel. Haenk. 1: 280. 1830.

Type locality, "in Acapulco."

RANGE: Pacific coast from Lower California to Salvador.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Cape St. Lucas, *Xantus* 121. San José del Cabo, *Purpus* 529; *Brandeggee* 42 in 1890, 43 in 1899, September, 1893, October, 1902. La Paz, *Palmer* 124.

SINALOA: Mazatlán, *Rose, Standley & Russell* 14018. Altata, *Rose, Standley & Russell* 14832.

TEPIC: María Madre Island, *Maltby* 71.

COLIMA: Socorro Island, *Barkewell* 183. Manzanillo, *Palmer* 1384 in 1891.

GUERRERO: Acapulco, *Palmer* 235 in 1895, 443½ in 1895.

OAXACA: San Angustín, *Liebmann* 479. Santa Cruz, *Liebmann* 480.

126. **AGROPYRON** Beauv. Ess. Agrost. 101. pl. 20. f. 1, 2. 1812.

WHEAT GRASS.

KEY TO THE SPECIES.

Lemmas awned, the awn longer than the lemma, spreading..... 3. *A. arizonicum*.

Lemmas awnless or with short straight awns.

Plants producing rhizomes..... 1. *A. repens*.

Plants without rhizomes..... 2. *A. tenerum*.

1. **Agropyron repens** (L.) Beauv. Ess. Agrost. 102, 146. 1812.

QUACK GRASS.

*Triticum repens* L. Sp. Pl. 86. 1753.

Type locality, Europe [Sweden].

RANGE: Introduced from Europe; weed in the eastern United States, rare on the Pacific coast and in Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, *Hitchcock* 7706.

DURANGO: Otinapa, *Palmer* 347 in 1906.

HIDALGO: Cuyamboya, *Pringle* 13432. Pachuca, sandy river bed, *Hitchcock* 6769.

PUEBLA: Chalchicomula, along railway, *Hitchcock* 6306.



**2. *Agropyrum tenerum* Vasey, Bot. Gaz. 10: 258. 1885.**

Type locality, "Rocky Mountains."

RANGE: Labrador to Alaska and southward to northern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Las Juntas, *Orcutt* 1163. Without locality, *Orcutt* in 1889.CHIHUAHUA: Colonia García, meadow valley, *Townsend & Barber* 328.**3. *Agropyron arizonicum* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 27. 1897.**

Type locality, "In the mountains of \* \* \* Arizona."

RANGE: Southwestern United States and northern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sierra Madre, *Nelson* 6495a; cool ledges, *Pringle* 1439. Colonia García, *Townsend & Barber* 337. Sánchez, *Hitchcock* 7711. Canyon de San Diego, *Hartman* 805.**127. HORDEUM L. Sp. Pl. 84. 1753.**

BARLEY. WILD BARLEY. FOXTAIL.

## KEY TO THE SPECIES.

- Plants perennial; awns an inch long or more; lateral spikelets reduced to slender awns..... 1. *H. jubatum*.  
 Plants annual; some of the glumes dilated.  
     Glumes, or some of them, ciliate..... 3. *H. murinum*.  
     Glumes not ciliate..... 2. *H. pusillum*.

**1. *Hordeum jubatum* L. Sp. Pl. 85. 1753.***Hordeum adscensionis* H. B. K. Nov. Gen. & Sp. 1: 180. 1816.

Type locality, "in Canada," the type specimen collected by Kalm.

RANGE: Ontario to Alaska and southward, adventive in Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

MÉXICO: Federal District, along trolley, Xochimilco, *Hitchcock* 5873, 5877; *Orcutt* 4101.**2. *Hordeum pusillum* Nutt. Gen. Pl. 1: 87. 1818.**

Type locality, "On the arid and saline plains of the Missouri."

RANGE: Middle and western United States to northern Mexico.

HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Sánchez, along railway, *Hitchcock* 7694.**3. *Hordeum murinum* L. Sp. Pl. 85. 1753.**

Type locality, Europe [Sweden].

RANGE: Pacific slope from Idaho to Vancouver Island and south into Lower California; introduced from Europe.

HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Guadalupe Island, *Palmer* 671 in 1889. Nachognero Valley, *Schoenfeldt* 3449.**128. ELYMUS L. Sp. Pl. 83. 1753.**

WILD RYE.

## KEY TO THE SPECIES.

- Plants producing rhizomes; awn shorter than the lemma or none. 1. *E. triticoides*.  
 Plants not producing rhizomes; awn longer than the lemmas.  
     Glumes subulate, 1 to 2-nerved..... 2. *E. pringlei*.  
     Glumes lanceolate, 3 to 5-nerved..... 3. *E. brachystachyus*.



**1. *Elymus triticoides* Buckl. Proc. Acad. Phila. 1862: 99. 1863.**

Type locality, "Rocky Mountains," the type specimen collected by Nuttall.

RANGE: Western United States and Lower California.

## HERBARIUM SPECIMENS FROM MEXICO:

LOWER CALIFORNIA: Tecate River, near Monument no. 245, *Schoenfeldt* 3726.  
Sierras Cantillas, *Orcutt* 1152. Topo, *Orcutt* 1162. Las Juntas, *Orcutt* 1164.  
Mountains, *Orcutt* in August, 1884.

**2. *Elymus pringlei* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 24: 30. 1901.**

Type locality, "in a valley near Tula, State of Hidalgo," the type specimen collected by Pringle (no. 6637).

RANGE: Highlands of Mexico.

## HERBARIUM SPECIMENS:

SAN LUIS POTOSÍ: Las Canóas, rich copse, *Hitchcock* 5763.  
HIDALGO: Ixmiquilpan, river banks, *Rose, Painter & Rose* 9060. Tula, wet soil,  
*Pringle* 6639. Dublán, wet soil, *Pringle* 11222.  
VERACRUZ: Orizaba, roadside ditch, Río Blanco, *Hitchcock* 6316; *Botteri* 142.

**3. *Elymus brachystachyus* Scribn. & Ball, U. S. Dept. Agr. Div. Agrost. Bull. 24: 47. f. 21. 1901.**

Type locality, "in the Indian Territory," the type specimen collected by Palmer (no. 420).

RANGE: Southern United States and northern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

CHIHUAHUA: Chihuahua, along aqueduct, *Hitchcock* 7771. Valley near Chihuahua, *Pringle* 505.  
COAHUILA: Saltillo, along irrigation ditch, *Hitchcock* 5603; along shady ditch, *Hitchcock* 5622; in old orchard, *Palmer* 260 in 1898.

**129. SITANION Raf. Journ. de Phys. 89: 103. 1819.**

## KEY TO THE SPECIES.

Glumes cleft into several lobes; lemmas glabrous..... 1. *S. jubatum*.  
Glumes entire; lemmas hirsute-scabrous..... 2. *S. pubiflorum*.

**1. *Sitanion jubatum* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 10. 1899.**

Type locality, "Waitsburg, Wash.," the type specimen collected by Horner (no. 573).

RANGE: Pacific coast from Washington to Lower California.

## HERBARIUM SPECIMEN FROM MEXICO:

LOWER CALIFORNIA: Nachognero Valley, *Schoenfeldt* 3439.**2. *Sitanion pubiflorum* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 19. 1899.**Type locality, "Tucson, Ariz.," the type specimen collected by Toumey (no. 795).  
RANGE: Southwestern United States to southern Mexico.

## HERBARIUM SPECIMENS FROM MEXICO:

HIDALGO: Cerro Ventoso above Pachuca, *Pringle* 6944. Pachuca, sandy river bed, *Hitchcock* 6765. El Salto, hills, *Pringle* 9568.  
PUEBLA: Esperanza, rocky hill, *Hitchcock* 6482.

**130. ARUNDINARIA Michx. Fl. Bor. Amer. 1: 73. 1803.**

## KEY TO SPECIES.

Blades 2 mm. wide; lemmas 1 to 1.5 mm. wide..... 1. *A. acuminata*.  
Blades 5 to 8 mm. wide; lemmas 2 mm. wide..... 2. *A. longifolia*.



**1. *Arundinaria acuminata* Munro, Trans. Linn. Soc. Bot. 26: 25. 1868.**

Type locality, "Mexico, Dep. Vera Cruz," the type specimen collected by Liebmann (no. 73).

RANGE: Known only from Veracruz.

## HERBARIUM SPECIMEN:

VERACRUZ: Xalcomulco, *Liebmann* 127.

**2. *Arundinaria longifolia* Fourn. Mex. Pl. 2: 131. 1886.**

Type locality, "Jicaltepec," the type specimen collected by Liebmann.

RANGE: Central to southern Mexico.

## HERBARIUM SPECIMENS:

DURANGO: Huasemote, *Rose* 3494.

TEPIC: Between Pedro Paulo and San Blascito, *Rose* 3344.

SAN LUIS POTOSÍ: Rascón, *Palmer* 650 in 1905.

OAXACA: Las Sedas, wet calcareous bluffs, *Pringle* 6742.

**131. *ARTHROSTYLIDIUM* Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3<sup>1</sup>: 117. 1839.****1. *Arthrostylidium racemiflorum* Steud. Syn. Pl. Glum. 1: 336. 1854.**

Type locality, "Mexico," the type specimen collected by Ghiesbreght (no. 234).

RANGE: Southern Mexico.

## HERBARIUM SPECIMENS:

VERACRUZ: Mirador, *Nelson* 78, *Liebmann* 126. Zacuapan, *Liebmann* 144; moist forest banks, *Purpus* 2892.

**132. *CHUSQUEA* Kunth, Syn. Pl. Aequin. 1: 254. 1822.**

## KEY TO THE SPECIES.

Branchlets pubescent; base of sheath tumid..... 1. *C. nelsoni*.  
Branchlets glabrous; base of sheath not tumid..... 2. *C. bilimeki*.

**1. *Chusquea nelsoni* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 16. 1897.**

Type locality, "between Chilapa and Tuxtla, Guerrero," the type specimen collected by Nelson (no. 2612).

RANGE: Known only from the type collection.

**2. *Chusquea bilimeki* Fourn. Mex. Pl. 2: 132. 1886.**

Type locality, "In convalle Mexicensi," the type specimen collected by Bilimek.

RANGE: Known only from the type locality.

## HERBARIUM SPECIMEN:

MÉXICO: Valley of Mexico, *Bilimek* 448.

**133. *BAMBOS* Retz. Obs. Bot. 5: 24. 1789.****1. *Bambos aculeata* (Rupr.).**

*Guadua aculeata* Rupr.; Fourn. Mex. Pl. 2: 130. 1886.

Type locality, "Colipa."

RANGE: Southeastern Mexico.

## HERBARIUM SPECIMEN:

VERACRUZ: Colipa, *Liebmann* 136.



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# STUDIES OF TROPICAL AMERICAN FERNS—NO. 5.

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By WILLIAM R. MAXON.

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## INTRODUCTION.

The following paper, like earlier ones published<sup>1</sup> under the same collective title, relates mainly to lesser groups of tropical American ferns which have been either neglected or very generally misunderstood. Examples of the latter sort are found in *Hemitelia* (section *Euhemitelia*) and the group of *Polypodium duale*; and of the former in the American representatives of the genus *Oleandra*. The last mentioned fall under several readily recognized species, marked by excellent characters, and their classification was made comparatively easy by the presence of sufficient material and a definite knowledge of the few species previously described. The study of *Euhemitelia* and of the *Polypodium duale* group, however, offered the usual difficulties connected with an examination of scattered type specimens.

The case of *Polypodium myosuroides*, a species of the last group, affords indeed an excellent illustration of the value of type specimens, since it involves the mistaken application of this name for exactly 100 years. As explained below, the name *Polypodium myosuroides* was given by Swartz in 1788 to certain Jamaican specimens of which it is peculiarly descriptive. In 1804 Schkuhr figured mistakenly, as an example of *myosuroides*, a second Jamaican species. Later authors, including Willdenow and Swartz himself, accepted Schkuhr's plate as illustrating *P. myosuroides*, although it represents a very distinct species latterly distinguished by Jenman (under the wrong name) and renamed *P. delitescens* by the writer in 1905. The confusion of the two by Swartz and Willdenow is partially explained by the preservation of a small detached frond of *P. delitescens* among the tufts of *P. myosuroides* in the Swartz herbarium at present and by the fact that both species are represented in the fragments sent by Swartz to Willdenow.

In the writer's opinion fern study is not seriously hampered by that lack of appreciation of the value of types which is evident among workers in some other groups. The confusion in the case just cited arose partly from a paucity of material, and a consequent failure

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<sup>1</sup> Contr. U. S. Nat. Herb. 10: 473-508. pls. 55, 56. March 30, 1908. Ibid. 13: 1-43. pls. 1-9. June 30, 1909. Ibid. 16: 25-62. pls. 18-34. June 19, 1912. Ibid. 17: 133-177. pls. 1-10. June 20, 1913.



to recognize in it two distinct species, and partly from the fact that the fragmentary specimens sent out by Swartz happened to include fronds which were not really of the species represented by the bulk of his original material. To a certain extent, then, Swartz's original specimens are a mixture, and the case on this account is somewhat unusual. But if it shows that, in rare instances, supposed portions of "original" specimens of species so small as this are not necessarily authentic, it points out at the same time the greater necessity that often exists for studying at first hand the actual type of a species. That blind adherence should be given to characters offered by a figure or by a fragment of a purported "type," if it be opposed to a satisfactory original diagnosis bringing out a very different set of characters, is scarcely to be thought of; nor on the other hand a similar adherence to a diagnosis that is obviously faulty, if there be available an illustration that is dependable. As a matter of fact it happens not infrequently that an examination of the actual type will harmonize errors of both the artist and the describer of a species.

On every account, therefore, it is of the highest possible necessity that actual type specimens shall not only be carefully preserved but very plainly indicated as such. Considering the far-reaching importance of the subject it is, furthermore, rather astonishing that in certain quarters the "type idea" should be so utterly ignored or even deprecated and in others so little understood as to be of no especial value to either an author or his readers.

### THE AMERICAN SPECIES OF OLEANDRA.

In Christensen's Index Filicum only two species of *Oleandra* are recognized from North and South America. One of these, *Oleandra nodosa*, is a common species which, as explained hereafter, must bear the older name *O. articulata*. The other species, *O. nerviiformis*, was described originally from the Philippines; and the American plants associated hitherto under this name are not only distinct from the Philippine, as might be expected, but represent not less than eight readily recognizable species. Of these, two, *O. pilosa* Hook. and *O. trujillensis* Karst., from the Guianas and Venezuela, were published long ago, and six, from Central America, Panama, and Colombia, must now be described as new. There are in addition two valid species allied to *O. articulata*: *O. hirta* Brack., from Brazil and the recently described *O. bradei*, from Costa Rica, making eleven in all from North and South America.<sup>1</sup>

These fall readily into two groups, as indicated in the key: The first, typified by *O. articulata* (*O. nodosa*), having the rhizomes

<sup>1</sup> An additional species, *O. micans* Kunze, from Peru, can not be determined from the short and wholly inadequate description. It is referred by Christensen to *O. nodosa*—that is, to *O. articulata* of this paper; but it is probably of the other group.



slender and more or less densely covered with spreading, linear-subulate scales; the other, comprising the *neriiformis* allies, having the rhizomes much stouter and completely obscured by appressed, densely imbricate, oblong-lanceolate to lance-acuminate scales. The two types are very distinct and the segregation of the species composing each group is not difficult. That only one species (*O. bradei*) should have been described from America during the last 50 years is remarkable, but perhaps attributable to lack of material. Even Kunze, in publishing a brief revision of the genus in 1851,<sup>1</sup> recognized only three American species: *O. nodosa*, *O. pilosa*, and *O. micans*, previously mentioned. Of Old World species he enumerated twelve (besides three doubtful ones), most of which have since been reduced to *O. neriiiformis*, though it is probable that they are well founded. Future collections will increase rather than decrease the number of American species here recognized.

The specimens here cited are all in the U. S. National Herbarium.

#### KEY TO THE SPECIES.

Rhizomes creeping, slender, squarrose-paleaceous.

Lamina hairy, long-decurrent ..... 1. *O. hirta*.

Lamina glabrous, cuneate at the base.

Rhizomes pruinose, laxly and deciduously paleaceous. 2. *O. bradei*.

Rhizomes brownish, densely and persistently paleaceous. .... 3. *O. articulata*.

Rhizomes ascending or climbing, densely appressed-paleaceous.

Phyllopodia 6 to 25 mm. long, slender, like the stipe.

Veins 14 to 18 per centimeter; scales of costæ orbicular-cordate to cordate, acute or acutish..... 4. *O. guatemalensis*.

Veins 20 to 28 per centimeter; scales of costæ smaller and darker, cordate-ovate or deltoid-ovate, acuminate ..... 5. *O. lehmannii*.

Phyllopodia 1 to 3 (rarely 5) mm. long, usually thick, oblique and at first densely paleaceous like the rhizomes.

Stipes wanting or nearly so, the lamina long-attenuate downward..... 6. *O. decurrens*.

Stipes 5 to 30 mm. long, the lamina sometimes narrowly cuneate, but always distinctly stipitate.

Indusia ciliate.

Veins 23 to 30 per centimeter; cilia of indusia long and persistent..... 7. *O. pilosa*.

Veins 16 or 17 per centimeter; cilia short and apparently few or caducous..... 8. *O. panamensis*.

Indusia not ciliate.

Costæ barbate-squamose and long-hirsute..... 9. *O. trujillensis*.

Costæ neither barbate-squamose nor long-hirsute.

Scales of costæ mostly lanceolate and glandular-fimbriate..... 10. *O. trinitensis*.

Scales of costæ deltoid, nearly all deeply lacerate-filamentose..... 11. *O. costaricensis*.

<sup>1</sup> Bot. Zeit. 9: 345-349. 1851.



1. *Oleandra hirta* Brack. in Wilkes, U. S. Expl. Exped. 16: 214. 1854.

TYPE LOCALITY: Organ Mountains, Brazil.

DISTRIBUTION: Brazil.

ILLUSTRATION: Op. cit. pl. 29.

Only the type specimen in the U. S. National Herbarium has been examined. This is well portrayed in the published plate. From its two near American relatives with spreading linear rhizome scales *O. hirta* may at once be distinguished by its hirsute surfaces and narrower, decurrent laminae.

2. *Oleandra bradei* Christ, Bull. Soc. Bot. Genève II. 1: 231. 1909.

TYPE LOCALITY: La Palma, Costa Rica, altitude 1,300 meters (*C. Brade*).

DISTRIBUTION: Known only from Costa Rica.

*Oleandra bradei* is very much smaller than the next species and is well marked by its whitish rhizomes and fewer, more laxly spreading scales.

SPECIMENS EXAMINED:

COSTA RICA: Vicinity of La Palma, alt. 1,450 to 1,550 meters, on tree trunk at edge of forest, *Maxon* 389, 404.

3. *Oleandra articulata* (Swartz) Presl, Tent. Pter. 78. 1836, as to name only.

*Aspidium articulatum* Swartz, Journ. Bot. Schrad. 1800<sup>2</sup>: 30. 1801.

*Polypodium articulatum* Poir. in Lam. Encycl. 5: 514. 1804, in part.

*Aspidium nodosum* Willd. Sp. Pl. 5: 211. 1810.

*Oleandra nodosa* Presl, Tent. Pter. 78. 1836.

TYPE LOCALITY: Martinique (*Plumier*).

DISTRIBUTION: General in the West Indies; on the continent extending from Guatemala to Panama, Guiana, and Brazil (São Paulo).

ILLUSTRATION: Plum. Trait. Foug. pl. 136; Schkuhr, Krypt. Gewächse. 1: pl. 27. 1804.

The original description of *Aspidium articulatum* in Schrader's Journal reads as follows:

*A. articulatum*, frondibus ellipticis glaberrimis, punctis fructif. catenulatis sparsis, stipitibus articulatis e stolone repente.\*

Plum. fil. t. 136.

Plumier's illustration, which represents a Martinique specimen, is thus (so far as the published record goes) the sole basis of Swartz's description of this common tropical American species. Poiret, however, in 1804 extended the limits of *A. articulatum* by including specimens from Mauritius, in which he was followed also by Swartz.<sup>1</sup> Willdenow, in 1810, perceiving the species to have become an aggregate, divided it into two; but unfortunately he retained the name *articulatum* for the Mauritius element and gave the new name *nodosum* to the Martinique plant of Plumier, which really should have been and must now be regarded as the type of *articulatum*.

There being, however, the possibility that Swartz had drawn his original diagnosis at least in part from a Mauritius plant (notwithstanding his citation of the Plumier figure), the writer asked Dr. Carl Lindman, of Stockholm, kindly to determine from the Swartzian herbarium: (1) Whether there is any indication that Swartz had a Mauritius plant at hand in 1801 and (2) whether his description was meant to include any besides the West Indian specimen of Plumier's figure. In reply both Doctor Lindman and his assistant, Dr. Erik L. Ekman, have expressed their entire agreement with the writer that the species was founded wholly upon Plumier's plate 136. Doctor Ekman states that "Swartz most probably had no West Indian specimen of *Asp. articulatum* at hand when he made his description, as there is none in his herbarium. However, he has, at a later occasion, identified with his *Asp. articulatum* of 1801 an Old World *Oleandra*, having short stipes, narrower lamina, somewhat broader squamæ, etc.,<sup>2,3</sup> this specimen being marked *Aspidium articulatum*, perhaps by Swartz's hand.

<sup>1</sup> Syn. Fil. 42, 236. 1806.



Doctor Ekman adds: "Swartz surely had not this Old World plant in his mind when he made the description of *Asp. articulatum*. It agrees not with the words 'frondibus ellipticis,' nor could he say 'stipitibus articulatis e stolone repente' according to this specimen, because there are no subterranean parts at all on it, the specimen consisting only of two laminae with their short stipes. I am absolutely convinced that Swartz had the Plumier figure before him when he made his description; and this illustration, thus, is the type of *Asp. articulatum* Swartz, 1801."

Under the circumstances it is manifestly proper to restore the name *articulatum* to the West Indian plant, as originally applied, and write *nodosum* as its synonym. The Mauritius plant wrongly called *Oleandra articulata* since Willdenow's time is thus left without a name, unless it proves identical with *Oleandra welwitschii* Baker, described originally from Angola.

#### 4. *Oleandra guatemalensis* Maxon, sp. nov.

Rhizome scandent, about 3 mm. thick, sparingly branched, densely appressed-paleaceous, the scales closely imbricate, lance-subulate from an oblong base, castaneous with lighter borders, slightly fimbriate; phyllopodia distant or subfasciculate, 8 to 25 mm. long, slender, naked or with a few scales at the base; stipes 0.5 to 4 cm. long, olivaceous, glabrous; lamina 10 to 35 cm. long, 2 to 3 cm. broad, broadly linear, slightly falcate, usually tapering in both directions from near the middle, cuneate at the base, the apex long-acuminate, conspicuously caudate; costa strongly elevated, greenish to light olivaceous, glabrous, scantily but persistently paleaceous (at least in the lower half), the scales borne at the sides, yellowish brown, nearly or quite concolorous, orbicular-cordate to cordate, acutish, glandular-denticulate; veins arising singly or in pairs, simple or once (rarely twice) forked, 14 to 18 per centimeter near the margin; sori about 1 mm. broad, usually few, forming an irregular series near the costa; indusia orbicular-reniform, perfectly entire, glabrous. Leaf tissue yellowish green, coriaceous (the margins cartilaginous and closely revolute), glabrous, or slightly glandular below.

Type in the U. S. National Herbarium, no. 473315, collected from a tree trunk in forest along the trail from Senahú to Actalá, Alta Verapaz, Guatemala, January 17, 1905, by William R. Maxon and Robert Hay (no. 3333).

##### ADDITIONAL SPECIMENS EXAMINED:

GUATEMALA: Trail from Esperanza to Purulhá, *Maxon & Hay* 3361. Coban, Dept. Alta Verapaz, alt. 1,300 meters, *von Türckheim* (J. D. Smith, no. 983). Forest near Coban, Alta Verapaz, alt. 1,600 meters, epiphytic, *von Türckheim* II. 2110.

*Oleandra guatemalensis* is nearest-related to *O. lehmannii*, from which it may be distinguished by the key characters. The fronds are actually and relatively broader and less coriaceous than in that species and the plants are of very different appearance.

#### 5. *Oleandra lehmannii* Maxon, sp. nov.

Rhizome scandent, similar to that of *O. guatemalensis*, but the scales a little shorter, narrower, more rigid, dark castaneous, short-fibrillose; phyllopodia mostly distant, 8 to 18 mm. long, slender, naked or scaly at the base; stipes 1 to 3.5 cm. long, light brown, slender; lamina 15 to 23 cm. long, 1.2 to 2 cm. broad, linear, straight or slightly falcate, gradually narrower in the basal third, narrowly cuneate, the apex rather abruptly long-acuminate, caudate; costa prominent, deciduously scaly at the sides in the lower half, the scales cordate-ovate to deltoid-ovate, glandular-denticulate, the lower ones more elongate; veins arising in 2's or 3's, simple or mostly once forked, 20 to 28 per centimeter near the margin; sori about 1 mm. in diameter, numerous, a single complete row close to the costa, an incomplete irregular second row beyond; indusia orbicular-reniform, small, glabrous. Leaf tissue lustrous, yellowish green, very coriaceous, glabrous, the margins strongly cartilaginous and broadly revolute.



Type in the U. S. National Herbarium, no. 828705, collected in forest south of and above Amalfi, Colombia, altitude 2,000 meters, October, 1884, by F. C. Lehmann (no. XLII).

ADDITIONAL SPECIMEN EXAMINED:

COLOMBIA: Western range of mountains above the City of Cali, alt. 1,800 to 2,200 meters, *Lehmann* 5165.

Related to *O. guatemalensis*, as mentioned under that species.

**6. *Oleandra decurrens* Maxon, sp. nov.**

Rhizome scandent, 2 to 3 mm. thick, sparingly branched, closely and densely appressed-paleaceous, the scales lance-attenuate, bright castaneous throughout, at first laxly short-fibrillose; phyllopodia mostly subfasciculate at intervals, stout, short (1 to 1.5 mm. long), nearly or quite as broad, oblique, densely paleaceous; fronds sessile or nearly so, the stipe never more than 5 mm. long; lamina 15 to 23 cm. long, 2 to 2.8 cm. broad, linear-oblongate, acuminate-caudate, tapering gradually from the apical third to a slender long-attenuate alate base; costa prominent, relatively slender, densely but minutely glandular-pubescent, delicately paleaceous nearly throughout, the scales spreading, linear-lanceolate, long-attenuate, 1.5 to 2 mm. long, bright yellowish brown, the lower ones more or less fibrillose; veins arising mostly in 2's, simple or forked below the middle, 22 to 26 per centimeter near the margin; sori less than 1 mm. broad, mostly scattering, 2 to 6 mm. from the costa, forming a very irregular double row; indusia orbicular-reniform, small, long-ciliate and copiously pilose. Leaf tissue rigidly herbaceous, minutely pubescent (conspicuously so beneath), the margins slightly cartilaginous, persistently ciliate.

Type in the U. S. National Herbarium, no. 828702, collected at El General, Costa Rica, January, 1897, by H. Pittier (no. 10649).

A strongly marked species, unique among related species of this group in its long-decurrent, nearly or quite exstipitate fronds.

**7. *Oleandra pilosa* Hook. in Hook. & Bauer, Gen. Fil. *pl.* 45. *B.* 1840.**

TYPE LOCALITY: Berbice, British Guiana (*Schomburgk* 416).

DISTRIBUTION: Apparently known only from the three Guianas and Colombia.

ILLUSTRATIONS: Hook. & Bauer, loc. cit.; Karst. Fl. Columb. 1: *pl.* 73. *f.* 6, 7.

In general appearance this species somewhat resembles *O. costaricensis* and *O. trinitensis*. It is immediately distinguished from them by its long-ciliate indusia.

SPECIMENS EXAMINED:

FRENCH GUIANA: "Oyapok superior," epiphytic in the tops of trees, *Leprieur* 1.

Without locality, *Leprieur* 2. Upon trunks of trees, in forest, rare, *Leprieur* 24.

COLOMBIA: Between Boca del Monte and Medina, province Cundinamarca, *Stübel* 669.

**8. *Oleandra panamensis* Maxon, sp. nov.**

Rhizome scandent, 2 to 4 mm. in diameter, densely appressed-paleaceous, the scales closely imbricate, lance-subulate, castaneous, at first conspicuously crinite-filamentous; phyllopodia subfasciculate in distant zones, 2 to 3 mm. long, stout, oblique, knob-like, paleaceous; stipes 1 to 1.5 cm. long, olivaceous; lamina 28 to 38 cm. long, 2.5 to 3.5 cm. broad, narrowly linear-oblongate, subfalcate, acuminate, long-caudate, tapering very gradually from above the middle downward to the narrowly cuneate (not long-attenuate) base; costa strongly elevated, stout, olivaceous, conspicuously glandular-pubescent, sparsely paleaceous nearly throughout, the scales spreading, lanceolate-attenuate from a broader base, hair-pointed, conspicuously glandular-fimbriate, or the lower ones slightly broader at the base, darker, and somewhat crinite-fibrillose; veins arising in 2's or 3's, many of them forked at or below the middle, not close, 16 or 17 per centimeter near the margin; sori about 1 mm. broad, apart, 2 to 6 mm. distant from the costa, more than half of them arranged in an irregular



single series; indusia orbicular-reniform, small, minutely puberulous, sparingly short-ciliate. Leaf tissue membrano-papyraceous, yellowish green, persistently and conspicuously glandular-pubescent below, sparsely so above, the margins slightly undulate, persistently ciliate.

Type in the U. S. National Herbarium, no. 715543, collected upon the Cerro Vaca, eastern Chiriqui, Panama, altitude 900 to 1,136 meters, in forest, December 25 to 28, 1911, by H. Pittier (no. 5322).

Several specimens collected at the same locality show no variation except in size. This species is perhaps closest allied to *O. costaricensis*, from which it differs particularly in its larger and persistently short-pubescent fronds and in the slender, mostly non-crinite scales of the costa, as well as in its sparingly ciliate indusia and fewer veins.

**9. *Oleandra trujillensis* Karst. Fl. Columb. 1: 147. 1860.**

TYPE LOCALITY: Near Escuque, Venezuela, altitude 1,000 meters, upon rocks and tree trunks.

DISTRIBUTION: Apparently known only from the original locality.

ILLUSTRATIONS: Op. cit. 1: pl. 73. f. 1-5.

No specimens of this species have been seen by the writer; but Karsten's very full description and elaborate illustrations leave no doubt as to its identity and distinctness. It is said to be an inhabitant of the warm zone of the mountains about Mérida, and will doubtless be found in Colombia and eastern Panama.

**10. *Oleandra trinitensis* Maxon, sp. nov.**

Rhizome scandent, rather freely branched, 4 to 5 mm. thick, densely appressed-paleaceous, the scales lance-subulate, 4 to 6 mm. long, fimbriate, at first sparingly fibrillose toward the tip, bright castaneous; phyllopodia numerous, distant to approximate, stout, knob-like, oblique, at first concealed by the dense covering of scales; stipes 1 to 2 cm. long, olivaceous to brown; lamina 15 to 28 cm. long, 2.5 to 4 cm. broad, linear-oblong, ligulate, straight or rarely subfalcate, acuminate to long-acuminate, broadly and often abruptly cuneate at the inequilateral base; costa strongly elevated beneath, brownish or olivaceous, nearly glabrous, persistently paleaceous at the sides, the scales spreading, reddish-brown, lanceolate and slightly glandular-fimbriate, or the lower ones deltoid-lanceolate and strongly glandular-fimbriate; veins arising in 2's or 3's, sometimes branched, 19 to 23 per centimeter near the margin; sori small, situated 2 to 6 mm. from the costa (never against it), more than half of them arranged in an irregular single series; indusia small, orbicular-reniform, not ciliate, minutely glandular-pubescent. Leaf tissue membrano-chartaceous, highly lustrous, yellowish green, somewhat iridescent, minutely puberulent, glabrescent, delicately marginate, obscurely and very scantily ciliate, the hairs caducous.

Type in the U. S. National Herbarium, no. 50836, collected in Trinidad, 1877-78, by A. Fendler (no. 114).

ADDITIONAL SPECIMENS EXAMINED:

TRINIDAD: Heights of Aripo, *Coll. Bot. Gard. Trinidad* 333 (two sheets). Also a second sheet of the type collection.

An ally of *O. costaricensis*, from which it differs obviously in the strap-like shape of its fronds and the character of the costal scales.

**11. *Oleandra costaricensis* Maxon, sp. nov.**

Rhizome scandent, 2.5 to 5 mm. thick, densely appressed-paleaceous, the scales lance-subulate, castaneous and conspicuously crinite-fibrillose; phyllopodia distant to subfasciculate, 1 to 5 mm. long, densely paleaceous at first, thus appearing stout; stipes 0.5 to 2 cm. long, slender, light brown, deciduously paleaceous; lamina 15 to 25 cm. long, 1.5 to 4 cm. broad, very variable in shape, linear-oblong to linear-oblong, acuminate, long-caudate, gradually narrowed in the lower part and narrowly



cuneate (sometimes abruptly so); costa strongly elevated beneath, deciduously puberulous, noticeably but deciduously paleaceous at the sides, the scales reddish brown, deltoid, irregularly and deeply lacerate-filamentous; veins arising in 2's or 3's, 18 to 24 per centimeter near the margin; sori rather large, situated 1 to 7 mm. from the costa, mostly arranged in an irregular row; indusia subpersistent, not ciliate, nearly or quite glabrous. Leaf tissue varying from membrano-herbaceous to rigidly herbaceous, lustrous, often iridescent, minutely glandular-pubescent beneath but soon glabrescent.

Type in the U. S. National Herbarium, no. 366014, collected in forest at La Palma, Costa Rica, altitude 1,459 meters, September 8, 1898, by A. Tonduz (no. 12551).

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: Orosí, Finca Valverde, alt. 1,400 meters, *A. Brade* 16836. La Fortuna, between Cervantes and Pacayas, alt. 1,400 meters, on tree trunks, March, 1906, *Biolley*. Helechales del General, Vallée du Diquís, alt. 700 meters, *Pittier* 12011. Without locality, *Cooper*; *Wercklé*.

The above description is drawn mainly from the type specimen and a second sheet of the same collection. The additional specimens cited are mostly incomplete and either partially sterile or poorly dried, so that their reference here is attended with some doubt. They are like the type in minute characters, however, and especially in the characters afforded by the costal scales, which distinguish this species very clearly from the others here recognized. The older fronds appear to be glabrous; but it is possible in all cases to detect traces, at least, of the minute pubescence in protected places along the costa. The iridescent coloration, when present, is very striking.

### NOTES UPON POLYPODIUM DUALE AND ITS ALLIES.

The Jamaican fern first described by Swartz in 1788 under the name *Acrostichum serrulatum*, and since known generally as *Polypodium serrulatum* Mett., is one of a small group of species regarded by several writers in the past as constituting a separate genus, *Xiphopteris*, distinct from *Polypodium*. This group of species is not so recognized at present and can not be maintained as a valid genus, since there is nearly every gradation in form between its type species, "*Polypodium serrulatum*," and several small members of *Polypodium* (section *Eupolypodium*) related to *P. trichomanoides*. The name *serrulatum* not being available, however, for the type species just mentioned, the new name *duale* has been proposed by the writer in a recent paper.<sup>1</sup> The full synonymy of *P. duale* is given below.

The species which were associated with *P. duale* [*P. serrulatum* (Swartz) Mett.] by Hieronymus are treated in the following pages. Several of these, notably *P. myosuroides*, have been greatly misunderstood and neither Hieronymus<sup>2</sup> nor the writer<sup>3</sup> has heretofore been wholly successful in the effort to do away with existing confusion. In the present study the writer has had the advantage of examining most of the material in the Berlin herbarium, studied by Hieronymus, in addition to the ample series from Jamaica in the United States National Herbarium. But even with these specimens at hand

<sup>1</sup> Contr. U. S. Nat. Herb. **16**: 61. 1912. See also p. 399, below.

<sup>2</sup> *Hedwigia* **44**: 80-90. 1905.

<sup>3</sup> *Bull. Torrey Club* **32**: 73-75. 1905.



there remain several collections which can not be placed definitely at the present time. There will be, however, a decided advantage in fixing upon and illustrating the typical form of *P. myosuroides*, which apparently is confined to Jamaica, and the Jamaican species figured erroneously as *myosuroides* by Schkuhr and renamed *Polypodium delitescens* by the writer several years ago. With more ample material in the future it will be possible to determine whether either occurs upon the continent.

The following key is adapted from that of Hieronymus:

## KEY TO THE SPECIES.

- Rhizomes conspicuously elongate; scales of the rhizome delicate,  
with thin, fulvous partition walls . . . . . 1. *P. duale*.
- Rhizomes ascending; scales of the rhizome with thick, dark brown  
partition walls.
- Fertile fronds not sharply differentiated into two difform  
sterile and fertile parts . . . . . 3. *P. delitescens*.
- Fertile fronds sharply differentiated into a caudate fertile  
terminal portion and a difform inferior sterile portion.
- Margins devoid of dark bristle-like hairs . . . . . 6. *P. wittigianum*.
- Margins bearing minute, scattered, dark brown, bristle-  
like hairs.
- Sterile segments mostly oblong . . . . . 2. *P. myosuroides*.
- Sterile segments more numerous, mostly of a deltoid  
type, often broader than long.
- Leaf tissue thin, translucent; marginal hairs few  
and very minute . . . . . 5. *P. saffordii*.
- Leaf tissue thick, nearly opaque; marginal hairs  
evident, though small and fragile . . . . . 4. *P. strictissimum*.

1. *Polypodium duale* Maxon, Contr. U. S. Nat. Herb. 16: 61. 1912.

*Acrostichum serrulatum* Swartz, Prodr. Veg. Ind. Occ. 128. 1788.

*Grammitis serrulata* Swartz, Journ. Bot. Schrad. 1800<sup>2</sup>: 18. 1801.

*Asplenium serrulatum* Swartz, Fl. Ind. Occ. 3: 1607. 1806.

*Gymnopteris serrulata* Bernh. Neu. Journ. Bot. Schrad. 2<sup>2</sup>: 48. 1806.

*Xiphopteris serrulata* Kaulf. Enum. Fil. 85. 1824.

*Micropteris serrulata* Desv. Mém. Soc. Linn. Paris 6: 217. 1827.

*Micropteris orientalis* Desv. Mém. Soc. Linn. Paris 6: 217. 1827, not *Polypodium orientale* Gmel. 1791.

*Polypodium serrulatum* Mett. Fil. Hort. Lips. 30. 1856, not Swartz, 1801.

*Xiphopteris extensa* Fée, Mém. Foug. 11: 14. 1866, not *Polypodium extensum* Forst. 1786, Presl, 1825, nor Fée, 1869.

*Xiphopteris orientalis* Fourn. Compt. Rend. 81: 1140. 1875.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Common nearly throughout the American tropics; occurs also in Africa (Kamerun, Sierra Leone, Mauritius, and Madagascar).

ILLUSTRATIONS: Schkuhr, Krypt. Gewächs. pl. 7, in part (as *Grammitis serrulata*); Hook. Exot. Fl. pl. 78 (as *G. serrulata*); Presl, Tent. Pter. pl. 9. f. 2. (as *G. serrulata*); Fée, Gen. Fil. pl. 10. B (as *Xiphopteris serrulata*); Fée, Mém. Foug. 11: pl. 19. f. 3 (as *Xiphopteris extensa*).

The present species, peculiar as it is in several particulars, appears to have been little understood by the early writers on ferns and not until 1856 was it placed in



its proper genus, then by Mettenius, as *Polypodium serrulatum* (Swartz) Mett. This however, is an untenable name, having been given previously by Swartz (in 1801) to another Jamaican fern now known as *Dryopteris serrulata* (Swartz) C. Chr. The two other specific names, *orientalis* and *extensa*, given by Desvaux and Fée, respectively, are untenable under *Polypodium* and a new name has thus been found necessary.

No detailed description of the species is required, its marked specific characters having been stated repeatedly by various writers. Hieronymus<sup>1</sup> in particular has supplemented Mettenius's excellent diagnosis by ample descriptive notes. All of these authors, however, have failed to emphasize one peculiar feature of the venation—the upward course of the fertile veins close to the midvein before diverging obliquely toward the margin. The sori being basal and elongate are, therefore, borne against the midvein in a double and very nearly straight line, and are confluent at

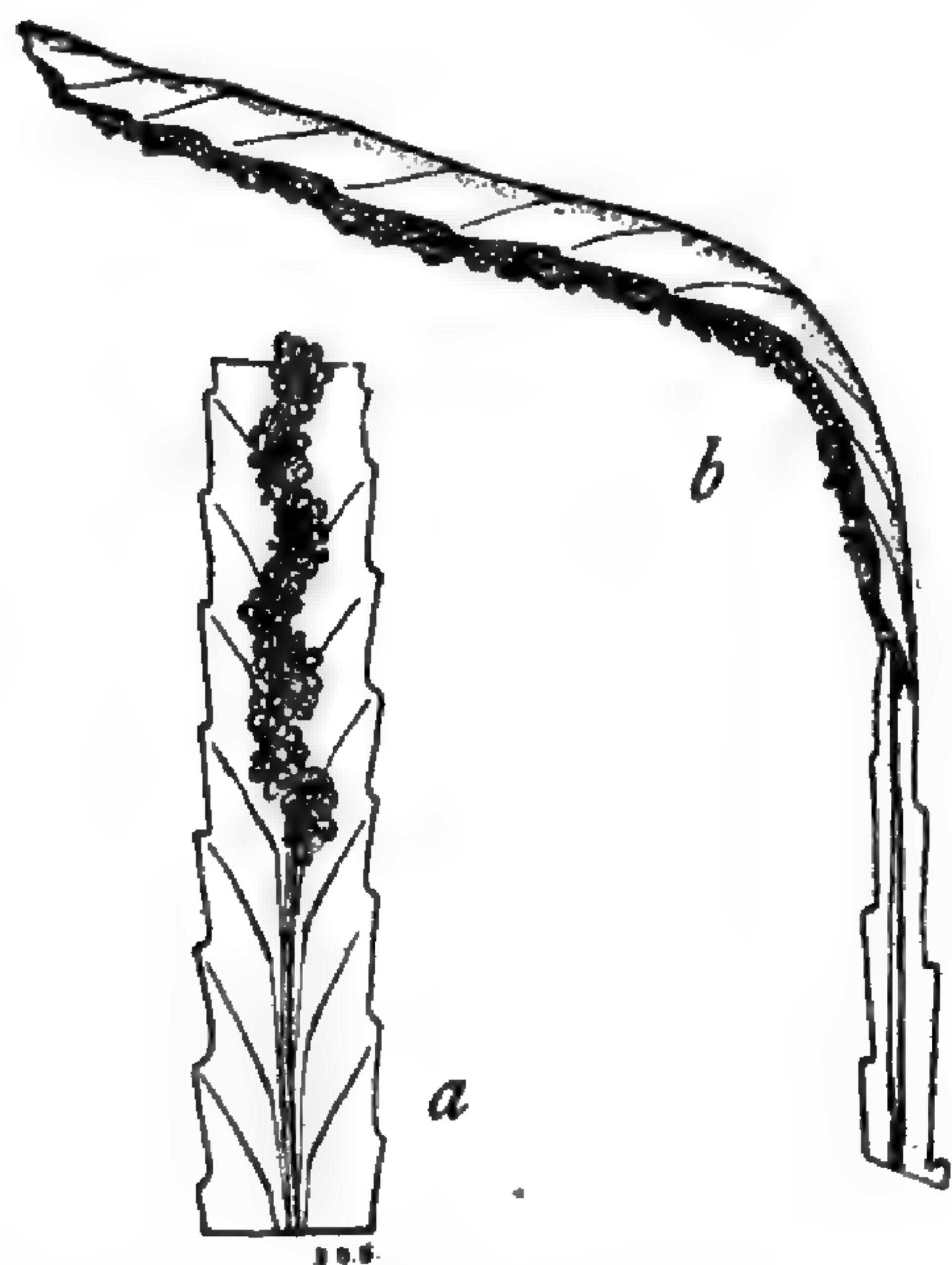


FIG. 8.—*Polypodium duale*, from Tweedside, Jamaica (Maxon 906). *a*, Lower view of fertile tip of lamina, showing the sori basal upon the veins and thus forming a sinuous line against the costa; *b*, tip of a fertile lamina, the fertile portion subplicate, a common condition at maturity. Scale 2.

all stages of growth. If the genus *Xiphopteris* of Kaulfuss is to be recognized, it must be restricted to this the type species, which differs conspicuously from most members of "*Eupolypodium*." But this character is only an extreme development of a tendency noted in several nearly related species and seems decidedly of less than generic importance. Hooker's plate, cited above, is excellent. The drawing by House, herewith reproduced (fig. 8), shows better, at twice natural size, the peculiar direction of the veins.

A long list of specimens is given by Hieronymus, many of these being of the older, historic collections. The following material, not cited by him, is in the U. S. National Herbarium:

JAMAICA: Second Breakfast Spring, alt. 600 meters, on wet, grassy slope, *Maxon* 906. Tweedside, alt. 600 meters, on mossy boulder, *Maxon* 980. Near Morces Gap, alt. 1,500 meters, on bank, *Maxon* 1218. Highest slopes of John Crow Peak, alt. 1,700 meters, on a mossy tree trunk, *Maxon* 1334. Vicinity

of New Haven Gap, alt. 1,650 meters, on mossy branches of forest trees, *Maxon* 2686. Cuna Cuna Pass, on rocks, *Fredholm* 3226. Morces Gap, *Harris* 7136; *Clute* 45. Northwest slopes of Dolphin Head, alt. 420 meters, *Harris* 9282. Near Cinchona, alt. 1,500 meters, on banks, *Underwood*. Without locality, *Hart* 102.

CUBA: Without definite locality, *Wright* 780.

HAYTI: Le Brande to Mount Balance, alt. 1,065 meters, on rocks, *Nash & Taylor* 1720.

PORTO RICO: Eastern slope of the Luquillo Mountains, alt. 450 meters, *Heller* 4620. Luquillo Mountains, *P. Wilson* 30, 69, 176. "Sierra de Naguabo," in arboribus vetustis sylvae montis "Piedra Belleta," *Sintenis* 1000. Mount Torresilla, *Hioram* 291.

ST. KITTS: Slopes of Mount Misery, on trees, *Britton & Cowell* 500.

GRENADA: "Morne au Camp," among mosses on trees, *Eggers* 6216. Without locality, *Sherring* 139.

ST. VINCENT: Souffrière, alt. 720 meters, among mosses on trees, *Eggers* 6709.

<sup>1</sup> *Hedwigia* 44: 80-83. 1905.





A. *POLYPODIUM MYOSUROIDES* SWARTZ.



B. *POLYPODIUM MYOSUROIDES* SWARTZ.



MONTSERRAT: Top of Chaners Mountains, alt. 900 meters, *Shafer* 292. Fergus Mountain, alt. 600 meters, *Shafer* 793.

GUADELOUPE: *Duss* 4099.

MARTINIQUE: *Duss* 1609.

TRINIDAD: *Fendler* 81; *Lockhart*.

MEXICO: Mirador, *Liebmann*. Zacuapan, Vera Cruz, on trees, *Purpus* 3021.

GUATEMALA: Coban, Alta Verapaz, alt. 1,350 meters, epiphytic, *von Türckheim* II. 1261. Near Finca Sepacuité, Alta Verapaz, *Cook & Griggs* 421, 535.

Trail from Senahú to Actalá, Alta Verapaz, on tree trunk in forest, *Maxon & Hay* 3319, 3330.

NICARAGUA: Greytown, *Wright*.

COSTA RICA: San José, *Pittier* 1928d. La Palma, alt. 1,400 meters, *C. Brade* 71.

Near Coliblanco, alt. 1,950 meters, on tree trunk, *Maxon* 282. La Palma, alt. 1,450 to 1,550 meters, *Maxon* 405.

PANAMA: Bismark, *Williams* 458.

COLOMBIA: Farallones de Cali, Cauca, alt. 2,000 meters, *Lehmann* 1982. Without locality, *Lehmann* 4933.

VENEZUELA: Juan Griego trail, Island of Margarita, alt. 450 meters, *Johnston* 144.

BRITISH GUIANA: "Our House," Mount Roraima, alt. about 1,725 meters, *im Thurn* 133.

BRAZIL: Serra do Itatiaia, *Dusen*. Minas Geraes, *Lindman* A181. Santa Catharina, *Schmalz* (Rosenstock, no. 145). Corcovado, *R. Rathbun*. Rio de Janeiro, *Mosén* 2639. Santos, *Mosén* 3731.

MAURITIUS: Without definite locality, *Mrs. Nicholas Pike*.

SIERRA LEONE: Without definite locality, *Barton*.

2. *Polypodium myosuroides* Swartz, Prodr. Veg. Ind. Occ. 131. 1788. PLATE 11. *Grammitis myosuroides* Swartz, Journ. Bot. Schrad. 1800<sup>2</sup>: 18. 1801, not Schkuhr, 1804.

*Xiphopteris myosuroides* Kaulf. Enum. Fil. 85, 275. 1824.

*Polypodium jamesoni* Jenman, Bull. Bot. Dept. Jamaica II. 4: 112. 1897, not *Xiphopteris jamesoni* Hook. 1860, nor *Polypodium jamesoni* Mett. 1883.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Higher peaks of the Blue Mountains, Jamaica, at 1,700 to 2,220 meters; of doubtful occurrence upon the continent.

*Polypodium myosuroides* was described originally by Swartz (in 1788) in the following words:

Frondibus pinnatifidis glabris, lobis in apicem lanceolatum coadunatis fructiferis; inferioribus remotis.

Although this description is both incomplete and inaccurate, the species name *myosuroides* is itself so peculiarly descriptive as to indicate clearly to which one of two closely allied species it was originally meant to apply. The introduction of a second species into the concept of *P. myosuroides*, and its later substitution for the species which should really bear that name, came about chiefly through Schkuhr's figuring (as *Grammitis myosuroides*) in 1804<sup>1</sup> a Jamaican plant, probably received from Swartz, that was not *myosuroides* but a distinct species (*Polypodium delitescens* Maxon, 1905). Whatever may have been the source of Schkuhr's specimen, Swartz evidently failed to recognize the two forms as specifically different. At any rate, in the Synopsis Filicum (1806) he cited Schkuhr's illustration without question under *myosuroides* and modified his original diagnosis materially, while in his Flora,<sup>2</sup> published in the same year, a long description is so worded as to include both forms. Both species being rare and not often collected and Swartz himself having cited Schkuhr's plate as illustrating *myosuroides*, most later writers have not unnaturally

<sup>1</sup> Krypt. Gewächs. 1: pl. 7. 1804.

<sup>2</sup> Fl. Ind. Occ. 3: 1644. 1806.



identified *myosuroides* with reference to Schkuhr's illustration. Thus Jenman, in his series of descriptions of the ferns of Jamaica, though properly distinguishing the two species, made the mistake of redescribing as *P. myosuroides* the species figured by Schkuhr. The true *myosuroides* of Swartz he called *Polypodium jamesoni* Jenman, since according to his view it was identical with *Xiphopteris jamesoni* Hook., a species described meanwhile from South American material, and thus did not require a new species name.

Having collected in Jamaica numerous specimens of the two species distinguished by Jenman, and having come to the conclusion that the name *myosuroides* had been applied erroneously by him, the writer published a short paper in 1905,<sup>1</sup> in which he restored *myosuroides* to its original application and, as previously noted, gave the name *Polypodium delitescens* to the species illustrated by Schkuhr. The main grounds for this were that the term *myosuroides*, meaning literally "mousetail-like," is not in the least appropriate to the plant figured by Schkuhr, but does exactly describe the slender, caudate, lightly sinuate-crenate fertile tips of the fronds of the other species.

While the writer's paper was in press there appeared the article by Hieronymus, in which the name *myosuroides* was used in a very doubtful sense and in which, also, the status of Schkuhr's plant was left in abeyance. The only Jamaican material of "*myosuroides*" cited by Hieronymus consists of several fragments received from Swartz which were held to be authentic. The writer thereupon sent to Dr. C. A. M. Lindman, at Stockholm, excellent specimens of what was believed to be true *myosuroides* and others representing the species figured by Schkuhr (*P. delitescens*), with the request that a comparison of these be made with Swartz's own material. Doctor Lindman replied promptly that immixed among the type tufts of *P. myosuroides* (so labeled in Swartz's own hand) he had found a single detached frond of *P. delitescens* which matched perfectly the writer's specimens of that species and the Schkuhr illustration. As substantiating this he inclosed "rubblings" of the single detached frond of *P. delitescens* and of some of the larger specimens of the type material of *P. myosuroides*. They exactly represent the two species as distinguished by the writer in 1905.

For the sake of historical clearness some further reference to Schkuhr's figure is necessary. Hieronymus points out that this was listed by Hooker under *P. setosum* (*P. micropteris* C. Chr.) and by Mettenius under *P. myosuroides*. His further comment, translated freely, is as follows:<sup>2</sup>

"Without an examination of the specimen which Schkuhr actually had in hand it would not be possible to say which of the two [i. e. Hooker or Mettenius] is right. Inasmuch as the figure shows no bristles upon the lamina and represents a plant from Jamaica (where *P. setosum* is apparently not found), one might incline to Mettenius's view and believe that it represents a young plant of *P. myosuroides* in which the fertile lamina (as exceptionally happens in this species) is not separated into two clearly differentiated parts. Still, it may be that a third (and as yet unknown) species is here represented."

Assuredly, *P. delitescens*, as shown in plate 12 and figure 10, has no near relationship with the South American *P. micropteris*. It is much nearer to *P. myosuroides* (pl. 11 and fig. 9), and the fact that Schkuhr's figure was cited under that species by Mettenius and was not definitely placed by Hieronymus may be attributed to the circumstance that the only Jamaican specimens of either *P. myosuroides* or *P. delitescens* in the Berlin herbarium are those received from Swartz. One of these (which was found mixed among specimens of *P. trichomanoides*) is fairly characteristic of *P. delitescens*. A second specimen, sent by Swartz in 1813, consists of parts of three detached fronds, two of which are *P. myosuroides*, the third being *P. delitescens*. The

<sup>1</sup> Bull. Torrey Club 32: 73-75. 1905.

<sup>2</sup> Op. cit. 92.



other Swartzian fragments (in the Willdenow Herbarium) have not been seen by the writer.

That Swartz's original specimens of "*P. myosuroides*" probably consisted in small part of a second species may be inferred from the presence of the single loose frond of *P. delitescens* found among the ample material of true *P. myosuroides* by Doctor Lindman, and from the mixed fragments of the two species which are preserved as authentic material of *P. myosuroides* at Berlin. It is probable also that Schkuhr's plant came from Swartz. Therefore, *Polypodium myosuroides* Swartz may be regarded technically as an aggregate. In this event the very significant species name itself must be admitted to indicate unquestionably its application to the plants having myosuroid apices (fig. 9). These apparently constituted the bulk of Swartz's material.

As to the three collections of Brazilian specimens in the Berlin herbarium, referred by Hieronymus to *P. myosuroides*: Sellow's no. 58 is apparently a small example of the form described by Hieronymus as *P. strictissimum* forma *major* Hieron.; Glaziou's no. 7491 is *P. schenckii* Hieron., as may be seen at once from its general form or, at least, from an examination of its peculiar rhizome scales; lastly, Glaziou's no. 7480, which is precisely the form long ago figured by Raddi,<sup>1</sup> represents either a new species or, more likely, a state of *P. strictissimum*. Further material of this last number is much to be desired.

The only other material cited by Hieronymus under *P. myosuroides* is Allers's no. 234, from German East Africa. This has not been seen by the writer.

The accompanying illustrations (fig. 9 and pl. 11) will serve to show the main characters of

*P. myosuroides* without further description. Comparative notes will be found also under *P. delitescens* and *P. strictissimum*.

The following specimens of *P. myosuroides* are in the U. S. National Herbarium:

JAMAICA: Summit of Blue Mountain Peak, alt. 2,220 meters, *Maxon* 1472, 1473, 1514; *Underwood* 1510. Below summit of Sir Johns Peak, altitude about 1,750 meters, *Underwood* 3180. Without locality, *Hart* 70. Also several specimens without exact locality, received from the Botanical Department of Jamaica.

EXPLANATION OF PLATE 11.—Specimens of *Polypodium myosuroides* from Blue Mountain Peak, Jamaica, altitude 2,220 meters. A, *Maxon* 1514; B, *Maxon* 1473. Natural size.

3. *Polypodium delitescens* Maxon, Bull. Torrey Club 32:74. 1905. PLATE 12. *Grammitis myosuroides* Schkuhr, Krypt. Gewächse. 1:9. 1804, not *Polypodium myosuroides* Swartz, 1788.

"*Polypodium myosuroides*" Jenman, Bull. Bot. Dept. Jamaica II. 4:112. 1897, not Swartz, 1788.

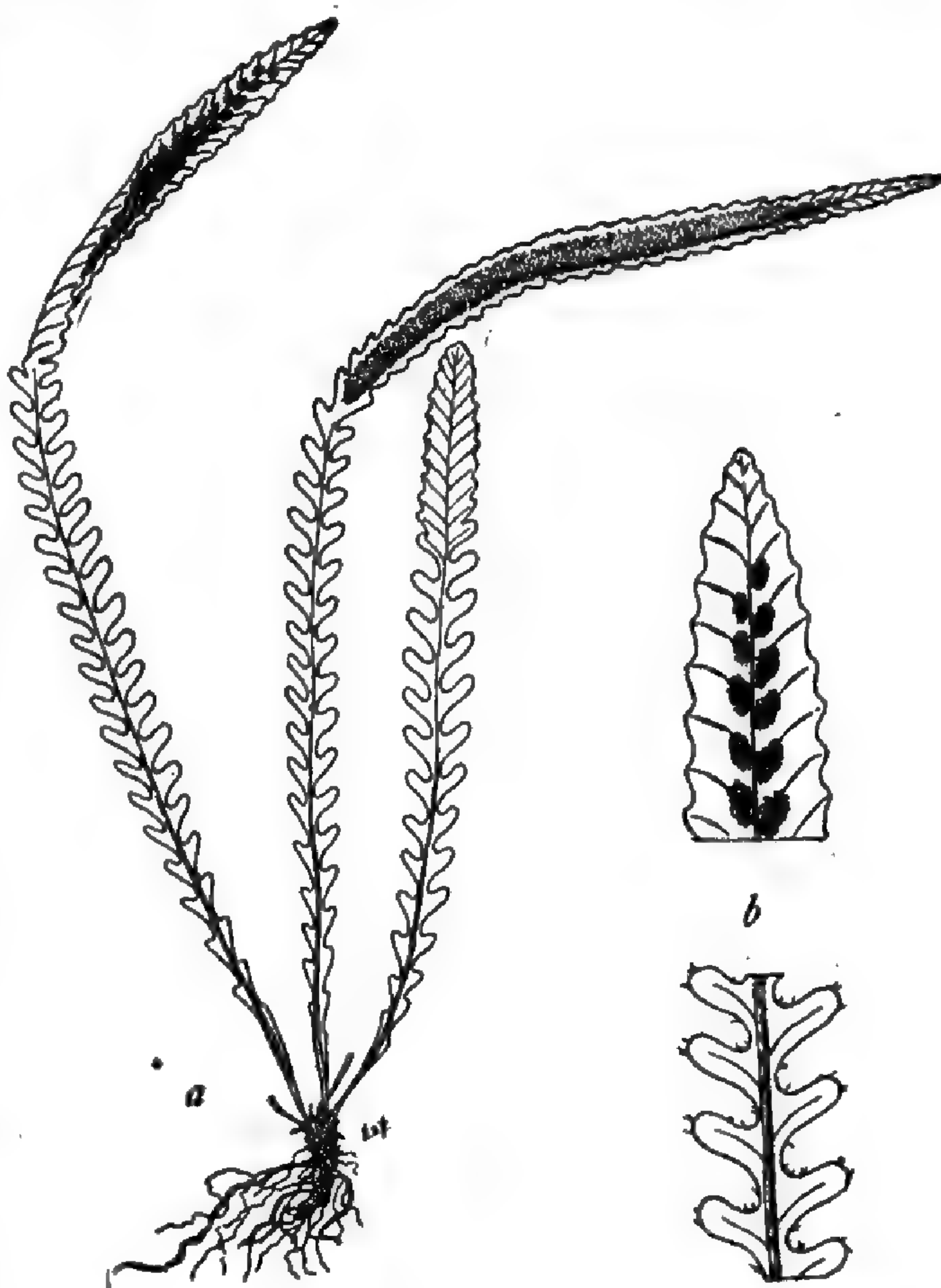


FIG. 9.—*Polypodium myosuroides*, from Blue Mountain Peak, Jamaica (*Maxon* 1473). a, An entire plant; b, the apex and a section of the sterile portion. a, Natural size; b, scale 2.

<sup>1</sup> Pl. Bras. 1: pl. 22 bis. f. 2, 2a. 1825 (as *Asplenium serrulatum*).



TYPE LOCALITY: Jamaica.<sup>1</sup>

DISTRIBUTION: Apparently confined to the high peaks of the Blue Mountains of Jamaica, altitude 1,700 to 2,220 meters.

ILLUSTRATION: Schkuhr, op. cit. pl. 7 (as *Grammitis myosuroides*).

The grounds for naming this species as above were given briefly by the writer in 1905<sup>2</sup> and have been restated, necessarily at some length, under the last preceding species. To be compared with Schkuhr's illustration are the Jamaican plants shown in plate 12 and figure 10, all of which represent *P. delitescens*. The writer's plant illustrated in figure 10 in particular is seen to agree closely with that of Schkuhr. Both represent a somewhat extreme form of *P. delitescens*, in which nearly all of the segments are distinct. Other specimens (for example, a part of those shown in pl. 12) have the upper lobes or segments somewhat confluent, the apex thus being less deeply

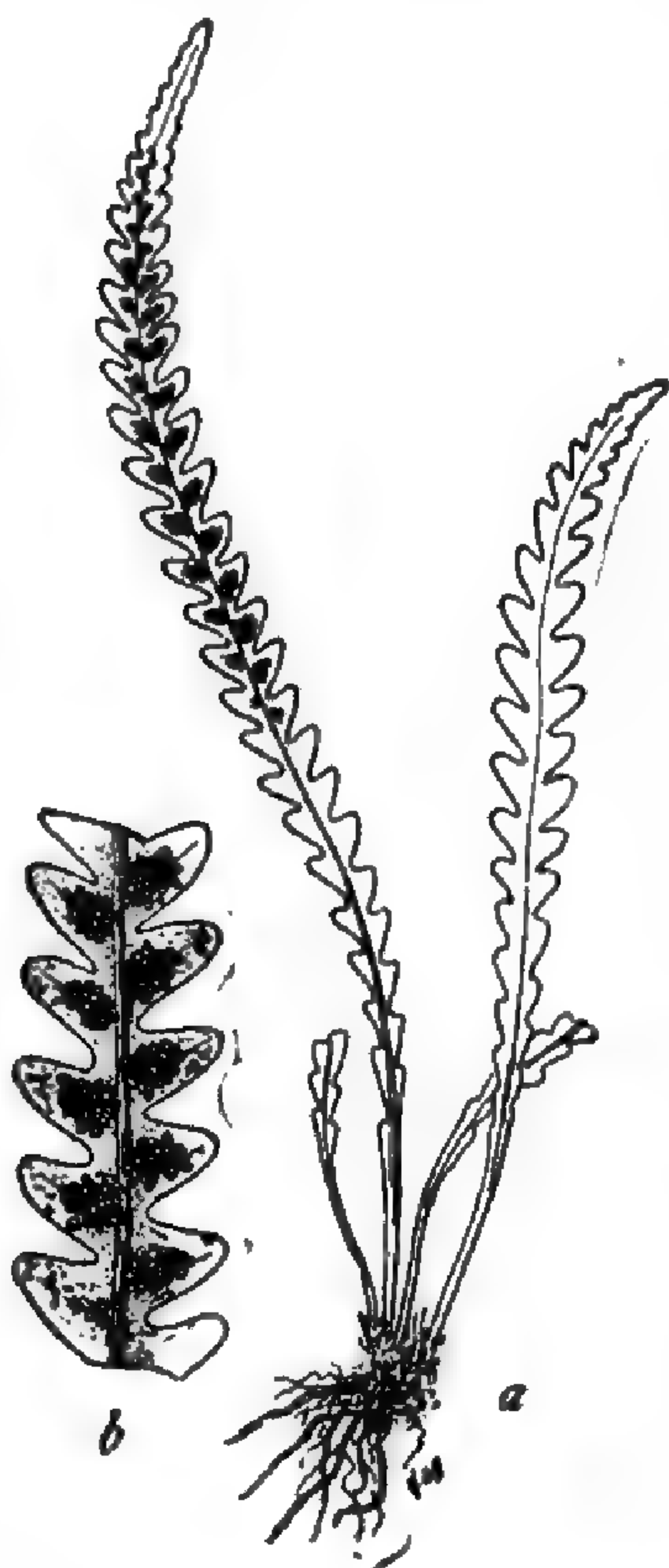


FIG. 10.—*Polypodium delitescens*, from Blue Mountain Peak, Jamaica (Maxon 1513). *a*, Entire plant; *b*, section of fertile portion. *a*, Natural size; *b*, scale 2.

incised. But it will be seen that in all of these conditions there is no sharp differentiation of a caudate fertile tip and that the sori are borne also upon the larger segments or lobes in the middle part of the blade. In other words, the apices of *P. delitescens* are usually deeply serrate or at least never assume the form characteristic of *P. myosuroides*, in which species there is invariably a sharp differentiation between the sterile and fertile portions, the latter being slender, elongate-caudate, and shallowly sinuate crenate. *Polypodium delitescens* differs otherwise from *P. myosuroides* in its approximate, nearly deltoid (instead of distant, oblong) segments and in the absence of dark bristle-like hairs upon the rachis and leaf margins. The sori, also, from their position upon separate or only partially fused lobes or segments are usually more or less distinct, never wholly losing their individuality, as Jenman has pointed out. The underside of the rachis is deciduously glandular-pubescent, instead of bristly-pubescent. The leaf tissue is much more opaque than that of *P. myosuroides*.

These two species are thus seen to be very dissimilar to each other, and their confusion in the past must be ascribed partly to lack of good material. That they should have been mixed in the original collection is not remarkable, since they are often found growing in close association upon the mossy branches and trunks of forest trees. Such a condition is not uncommon among many of the lower cryptogams, notably the Hepaticae, and has been observed repeatedly by the writer in the case of various small tropical American species of *Polypodium* and even of *Elaphoglossum*, where conditions have been unusually favorable to a luxuriant growth of related species requiring a similar habitat.

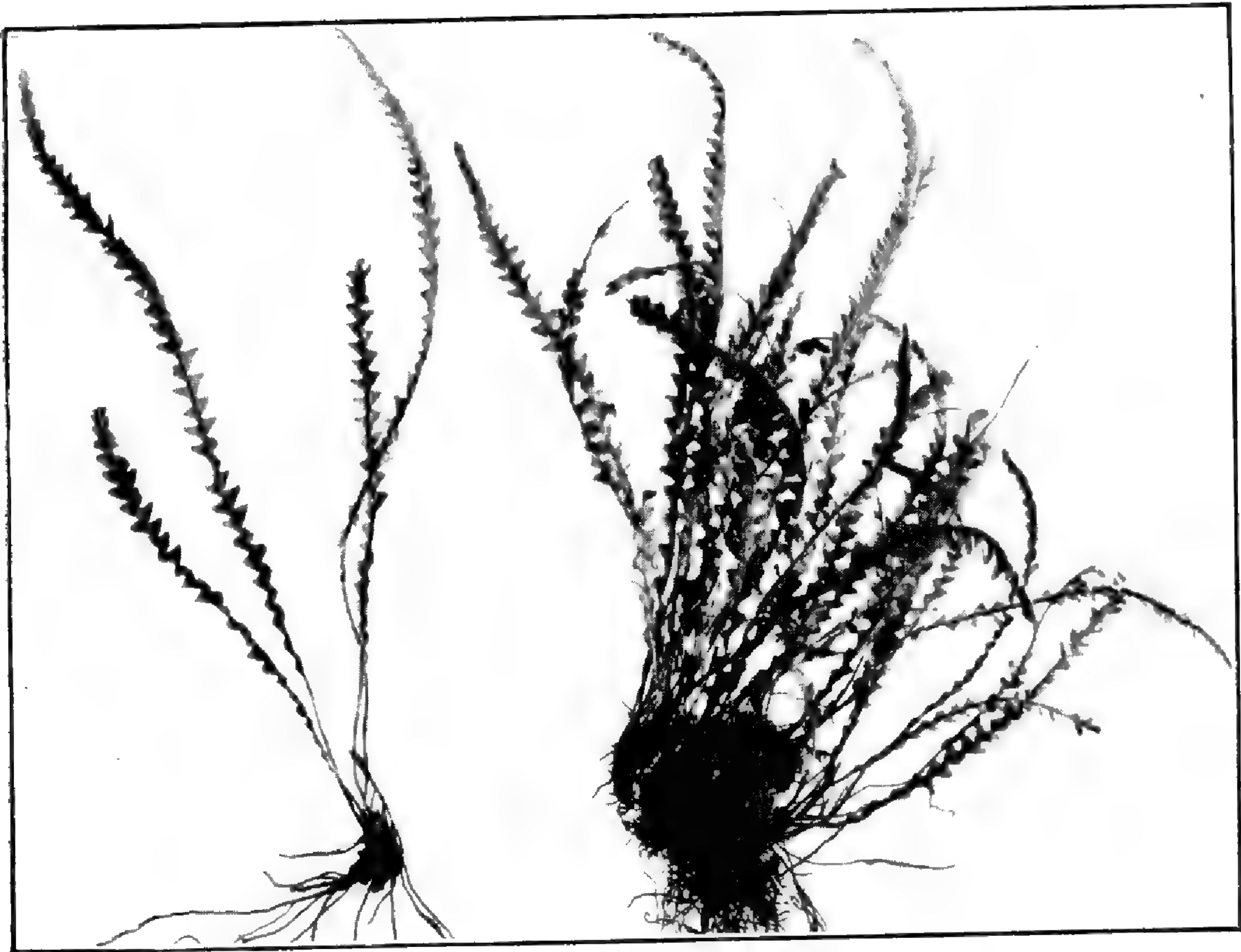
As noted above, *P. delitescens* is apparently confined to Jamaica. The following specimens are in the U. S. National Herbarium:

JAMAICA: Monkey Hill (above New Haven Gap), alt. 1,800 meters, Maxon 2732, 2750. Near New Haven Gap, alt. 1,700 meters, Underwood 962, 1019. Near

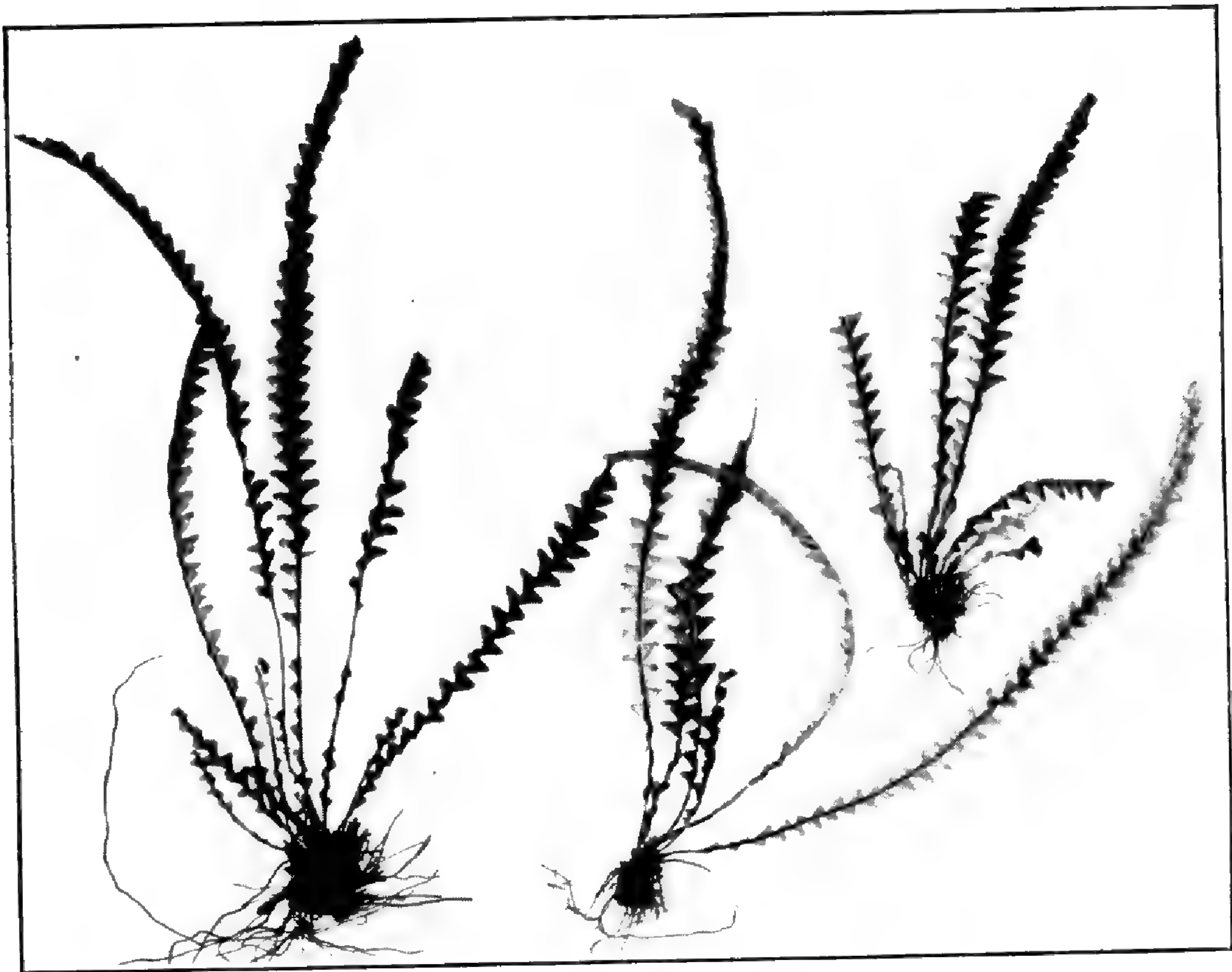
<sup>1</sup> The actual type will be Schkuhr's original plant, if extant; otherwise it will be Maxon 1513, U. S. National Herbarium 427770, as previously designated.

<sup>2</sup> Bull. Torrey Club. 32: 73-75. 1905.





A. POLYPODIUM DELITESCENS MAXON.



B. POLYPODIUM DELITESCENS MAXON.



Morces Gap, alt. 1,500 meters, *Underwood* 516. Summit of Blue Mountain Peak, alt. 2,220 meters, *Maxon* 1513. Without definite locality, *Hart* 73, 70 in small part.

EXPLANATION OF PLATE 12.—Plants of *Polypodium delitescens*, from the Blue Mountains of Jamaica. A *Maxon* 1513; B, *Maxon* 2732. Natural size.

4. *Polypodium strictissimum* (Hook.) Hieron. Bot. Jahrb. Engler 34: 501. 1904. *Xiphopteris jamesoni* Hook. Second Cent. Ferns pl. 14. 1860, not *Polypodium jamesoni* Mett., 1883, nor Jenman, 1897.

*Polypodium serrulatum*  $\beta$  *strictissimum* Hook. Sp. Fil. 4: 175. 1862.

TYPE LOCALITY: Andes of Quito, Ecuador (*Jameson*).

DISTRIBUTION: High mountains of Ecuador, Colombia, Venezuela, British Guiana, and Brazil, ascending to 3,000 meters.

ILLUSTRATIONS: Hook. Second Cent. Ferns pl. 14 (as *Xiphopteris jamesoni*); Hook. Gard. Ferns pl. 44 (as *Xiphopteris serrulata*).

The above names relate to South American plants, of which the writer had seen almost no examples in 1905 and which he then supposed to be referable to the Jamaican species, *P. myosuroides*. An examination of the specimens studied by Hieronymus, however, indicates that this material represents one or more species distinct from *P. myosuroides*.

Three forms of *P. strictissimum* are recognized by Hieronymus: forma *major*, forma *intermedia*, and forma *minor*. These differ widely among themselves, not only in size, but in shape of their lobes or segments. The type of Hooker's species, *Xiphopteris jamesoni*, and therefore of *Polypodium strictissimum* (Hook.) Hieron.<sup>1</sup>, is the Quitensian Andes plant of Jameson, illustrated in Hooker's plate 14, above cited. This would probably come under the forma *minor* of Hieronymus. Between this and the opposite extreme described as forma *major* there are several curious and more or less intermediate conditions, of which Hooker's plate 44 represents one. Whether or not these are all conspecific, they nevertheless represent a series of forms specifically distinct from *P. myosuroides*, differing from that species constantly in their more numerous, mostly triangular segments and in their rigidly upright fronds. It is not unlikely that further collections may make possible a segregation of these as several distinct species; but it must be remembered that differences in habitat, elevation, exposure, and particularly moisture conditions may induce these differences in form, as we know to be true in the case of *P. duale*. Without further material the writer prefers at present to view *P. strictissimum* in the sense of Hieronymus.

Besides the Berlin material only two specimens (both in the U. S. National Herbarium) have been studied, these being referable to the forma *minor*.

COLOMBIA: Cuesta de Tocotá, western Cordillera, Cauca, alt. 1,500 to 1,900 meters, *Pittier* 768.

BRITISH GUIANA: Old Path, upper slopes of Mount Roraima, *in Thurn* 351.

5. *Polypodium saffordii* Maxon, Amer. Fern Journ. 2: 19. 1912.

*Polypodium minimum* Brack. in Wilkes U. S. Expl. Exped. 16: 5. 1854, not Aubl. 1775.

TYPE LOCALITY: Mountains behind Honolulu, Island of Oahu, Hawaiian Islands.

DISTRIBUTION: Known only from the Hawaiian Islands, ascending to at least 1,200 meters.

ILLUSTRATIONS: Brack. op. cit. pl. 1. f. 3; Maxon, loc. cit. (text figs.).

This species, recently renamed and figured by the writer, was redescribed by Hieronymus under the name *P. minimum* Brack. It is readily distinguished from its

<sup>1</sup>The earlier name *Polypodium jamesoni* (Fée) Mett., 1883, precludes the transfer of *Xiphopteris jamesoni* Hook. to *Polypodium*. Hieronymus has thus properly elevated to specific rank Hooker's varietal name *strictissimum*, which, as published, is an exact synonym of *Xiphopteris jamesoni*.



relatives by the characters given in the key herewith. The figures published by the writer do not show any of the minute, bristle-like hairs which occur sparingly near the apices of the triangular lobes of the blade. Besides being few and very minute these are caducous.

**6. *Polypodium wittigianum*** (Fée & Glaz.) Christ, Bull. Herb. Boiss. II. 2: 368. 1902, as to name.

*Grammitis wittigiana* Fée & Glaz.; Fée, Crypt. Vasc. Brés. 2: 50. 1872-73.

*Grammitis muscosa* Fée, Crypt. Vasc. Brés. 2: 51. 1872-73.

TYPE LOCALITY: Itatiaia, Brazil, alt. 2,300 meters (Glaziou 5300).

DISTRIBUTION: Known only from Brazil.

ILLUSTRATIONS: Fée, op. cit. pl. 95. f. 1 (as *G. wittigiana*); op. cit. pl. 95. f. 2 (as *G. muscosa*).

Hieronimus's contention<sup>1</sup> that *Grammitis muscosa* represents a depauperate condition of the species described as *G. wittigiana* appears, from an examination of the type specimens of both, to be correct. *Polypodium wittigianum* as understood by Christ in 1902 included Schwacke's no. 839 from Brazil; but this, as represented in the Berlin herbarium, is *P. schenckii*. Ule's no. 4519, also cited by him, has not been seen.

There is a single additional collection in the U. S. National Herbarium, representing the smaller form of the species (described as *G. muscosa*).

BRAZIL: Pico Redondo, Retiro, Itatiaia, alt. 2,450 meters, June 29, 1902, Dusén 773.

#### EXCLUDED SPECIES.

**POLYPODIUM SCHENCKII** Hieron. Hedwigia 44: 87. 1905.

TYPE LOCALITY: Serra do Mar, near Joinville, province of Santa Catharina, Brazil (Schenck 1243).

DISTRIBUTION: Known only from Brazil.

*Polypodium schenckii*, though placed by Hieronimus with "*P. serrulatum*" and its allies, must be excluded from this group on account of its forked veins and ciliate rhizome scales. Besides the three collections cited by Hieronimus, the writer has examined specimens collected near the type locality by Schmalz (distributed by Rosenstock under no. 139) and Glaziou's no. 7491. The latter, as stated on page 403, was referred to *P. myosuroides* by Hieronimus.

#### NEW SPECIES OF POLYPODIUM.

In the course of studying certain American species of *Polypodium* the following have been distinguished as new. The first five are members of the group of *P. trichomanoides*, taken in a broad sense, of which the writer purposes to publish a synoptical review shortly.

***Polypodium hyalinum*** Maxon, sp. nov.

Rhizome ascending, slender, about 1 cm. long, 1.5 mm. in diameter, freely radicle below, the apex crowned with a conspicuous tuft of fulvous scales, these linear-lanceolate from a slightly broader cordate base, 2.5 to 4 mm. long, 0.5 to 0.7 mm. broad near the base (here 9 to 13 cells broad, the cells relatively large, irregularly oblong, with slightly thickened fulvous partition walls), sometimes bearing a few small, irregular, simple or forked, gland-tipped processes near the base, the apical half of the scale invariably provided with straight or slightly curved, divergent unicellular hyaline acicular cilia. Fronds 4 to 7, suberect, fasciculate, 8 to 13 cm. long; stipe subterete, brownish stramineous from a darker base, 5 to 10 mm. long, thickly beset

<sup>1</sup> Op. cit. 89.



with spreading reddish hairs 1.5 to 2 mm. long; lamina linear, 7 to 12 cm. long, 7 to 9 mm. broad in the middle, obliquely pinnatifid nearly to the rachis, gradually narrowed at the short-caudate pinnately lobed apex, more abruptly narrowed at the base, the lower segments distant, decurrent, finally evident only as a minute wing upon the rachis, the whole lamina long-setose, conspicuously so near the apex of the segments and upon the upper side of the rachis (the hairs like those of the stipe); segments monosorous, oblique, 25 to 40 pairs, close, narrowly deltoid-oblong, slightly decurrent, obtusish, entire (except at the minutely crenulate apex), yellowish green, chartaceous; veins of the sterile segments simple, the strongly clavate apex easily seen upon the upper surface as an elliptical hydathode distant about 1 mm. from the apex; veins of the fertile segments once forked near the base, the thickened apex of each branch evident as a hydathode; sori nearly terminal upon the short proximal branch, round, arising about 0.7 mm. from the rachis and borne against it at maturity, then about 1.5 mm. in diameter; annulus consisting of 13 or 14 cells; spores subglobose, minutely granulate.

Type in the U. S. National Herbarium, no. 833632, collected upon the forested upper slopes of the Volcán de Barba, Costa Rica, February 6, 1890, by H. Pittier (no. 1928).

*Polypodium hyalinum* is a member of the group of *P. trichomanoides* and probably finds its nearest ally in that species itself, from which it differs not only in the general appearance of its fewer fronds and in having the segments broader, more oblique, and not at all gibbous, but also very manifestly in its rhizome scales. These have the cells larger and relatively much broader and with partition walls distinctly thicker than in *P. trichomanoides*. They differ further in having from 10 to 17 spreading fragile hyaline cilia set closely upon each side of the apical half, the scales of *P. trichomanoides* being wholly devoid of cilia. Several similar species of this group have ciliate scales, but in these the cilia are dark brown and mostly longer and bristle-like. *Polypodium hyalinum*, which takes its name from the transparent cilia of the rhizome scales, may thus be readily distinguished by this unique character alone. It doubtless occurs upon other of the Costa Rican volcanoes.

***Polypodium blepharodes* Maxon, sp. nov.**

Rhizome erect or ascending, about 1 cm. long, 2.5 mm. in diameter, abundantly radicle; fronds numerous, 8 to 15 cm. long, erect, closely fasciculate, subimbricate at the base and partially concealing the inconspicuous scales of the rhizome, these 1.5 to 2 mm. long, light ferruginous with slightly darker borders, lanceolate to narrowly oblong-lanceolate, acuminate, attached just above the rounded base, 7 to 12 cells broad in the basal portion, the inner cells acutely elongate, mostly polyhedral, thin-walled, 3 to 5 times as long as broad, the outer cells shorter, narrowly oblong, and with thicker partition and outer walls; scales provided with 12 to 15 very long slender stiff reddish brown spreading bristle-like cilia upon each side and a similar longer terminal bristle; stipes slender, 0.3 to 0.4 mm. thick, 5 to 15 mm. long, thickly beset with slender fragile spreading reddish castaneous hairs about 1.5 mm. long; lamina linear, 8 to 14 cm. long, 4 to 6 (rarely 8) mm. broad, pinnatifid at a right angle nearly to the rachis, gradually narrower at the short-attenuate lobate apex; segments monosorous, 40 to 50 pairs, spreading, only the lowermost 1 to 3 pairs smaller, broadly triangular, and strongly decurrent, the others oblong to deltoid-oblong, inequilateral, short-decurrent, obtuse or subobtuse, slightly apart (or apparently subdistant by the curvature of the margins in drying), entire or in larger specimens lightly gibbous near the middle; whole lamina strongly long-setose, especially upon the under surface (including the rachis), the hairs like those of the stipe; veins obscure, very oblique at the base, those of the sterile segments simple or forked, those of the fertile segments invariably forked in their basal third, the distal branch terminating in a conspicuous hydathode remote from the rounded apex of the segment, the fertile proximal branch



oblique, exceeding the sorus, terminating in a slender hydathode remote from the rachis; sori round, relatively large, lying against the rachis at maturity, distinct or (in small fronds) fully confluent; annulus consisting of 15 or 16 cells; spores subglobose, shallowly granulate.

Type in the U. S. National Herbarium, no. 575795, collected upon a stump at the edge of the forest near La Palma, Costa Rica, altitude 1,450 to 1,550 meters, May 6 to 8, 1906, by William R. Maxon (no. 406).

The following additional specimens are in the U. S. National Herbarium:

COSTA RICA: Cañas Gordas, alt. 1,100 meters, *Pittier* 10976, in part. Vallé de Agua Buena (Cañas Gordas), *Pittier* 10973. San Jeronimo, alt. 1,500 meters, *Wercklé* (Jimenez, no. 557). Also several specimens without exact locality, *Wercklé* (ex herb. Christ).

GUATEMALA: Forests near Coban, Alta Verapaz, alt. 1,350 meters, *von Türckheim* (J. D. Smith, no. 946). Vicinity of Cacao (between Panzós and Senahú), *Barber* 160.

*Polypodium blepharodes* belongs to the group of *P. trichomanoides* and apparently is most nearly allied to *P. daguense* Hieron. and *P. taenifolium* Jenman (*P. sintenisii* Hieron.). From the former species, known only from Colombia, it differs in its larger, narrower, and more freely ciliate rhizome scales, its differently shaped segments, and its much longer leaf bristles, and in having the veins forked far below their middle, the proximal branch being longer than in *P. daguense*. From the West Indian *P. taenifolium* it differs widely in the cellular structure and color of its rhizome scales, in its longer fertile veinlets, and in its smaller and differently shaped fronds which are more freely setose, the hairs also much longer.

In some respects *P. blepharodes* recalls the problematical *P. gibbosum* Fée, but that imperfectly described species, whose exact origin also is doubtful, is figured by Fée as having few pinnules, the lower ones very long-decurrent upon the rachis, and the annulus is said to have 11 or 12 cells; in none of which characters does *P. blepharodes* agree.

***Polypodium cookii* Underw. & Maxon, sp. nov.**

Rhizome erect, about 8 mm. long, 5 mm. in diameter, bearing 4 to 8 erect closely fasciculate fronds from 3 to 7 cm. long; scales of the rhizome borne in a relatively conspicuous terminal tuft, pale yellowish brown in mass, concolorous, about 1.5 mm. long, deltoid-lanceolate or narrowly deltoid-ovate, entire, devoid of cilia or marginal teeth, attached just above the rounded base, attenuate, terminating in a slender curved tip consisting of a single series of 3 or 4 oblong cells; scales 7 to 12 cells broad in the basal part, the cells broadly to narrowly oblong, uniformly lutescent, translucent, the partition walls darker optically, thin but very distinct; stipe up to 7 mm. long, subterete, 0.5 mm. thick, or sometimes obsolete, the rachis then narrowly alate to the base of the frond; lamina 3 to 6.5 cm. long, 3 to 5 mm. broad, linear or sometimes very gradually narrower in the apical half (the tip short, noncaudate, obtusely lobed), pinnatifid throughout to within 0.5 mm. of the rachis, the basal portion slightly narrowed, only the lowermost pair of segments broadly triangular and long-decurrent; segments monosorous, 15 to 30 pairs, close, slightly oblique, all but the basal pair broadly oblong, nearly equilateral, obtusely rounded, long-setose (like the whole lamina), the hairs reddish brown, 1 to 1.6 mm. long, especially numerous at the minutely crenulate apices of the segments and upon the lower side of the rachis; veins simple, terminating in a conspicuous elliptical hydathode remote from the apex of the segment, slightly arcuate at the base, or those of the fertile segments more strongly so, the sorus being borne upon a roundish receptacle at the upper side of the bend of the vein; sori roundish, a little more than 1 mm. in diameter, nearly basal, spreading against the rachis and confluent at maturity; annulus consisting of 14 cells; spores subglobose, shallowly granulate. Leaf tissue rigidly spongiose-chartaceous, glandular-



pubescent (especially beneath), the hairs bifurcate from a basal cell, one branch unicellular, the other 2-celled, the second (terminal) cell strongly clavate and gland-like.

Type in the U. S. National Herbarium, no. 407781, consisting of a single plant collected near the Finca Sepacuité, Alta Verapaz, Guatemala, March 20, 1902, by Messrs. O. F. Cook and R. F. Griggs (no. 80). A second (smaller) plant of the same collection is in the Underwood Fern Herbarium, New York Botanical Garden.

*Polypodium cookii* also is of the *P. trichomanoides* group, but is wholly unlike any of the American species thus far described. In its simple veins it is like *P. hartii* Jenman and *P. limula* Christ, but these species are otherwise very different in nearly all characters, especially in their very narrow fronds, in their oblique, elongate sori (which occupy nearly the whole vein), in the absence of very long hairs upon the lamina, and in the wholly different cellular structure of their rhizome scales. *Polypodium cookii* is probably more nearly related to those species of the *trichomanoides* group which have the fertile veins forked, but it differs from all of these in having the scales perfectly entire, as well as in its simple veins. The sorus is exactly sessile upon the upper side of the vein.

***Polypodium perpusillum* Maxon, sp. nov.**

PLATE 13, A.

Plants very small, apparently clustered. Rhizome decumbent, 5 to 8 mm. long, very slender, with a copious covering of relatively large spreading scales nearly throughout, these light brown in mass, 1.5 to 2.2 mm. long, narrowly oblong-lanceolate or deltoid-lanceolate from a rounded distinctly cordate base, acute, entire (without teeth or cilia), 12 to 17 cells broad in the somewhat concave basal portion, the cells oblong to linear-oblong, uniformly pale yellowish brown, translucent, the partition walls a little darker visually, thin; fronds several, subfasciculate (1 to 3 mm. apart), 2.5 to 4.3 cm. long, erect or toward the base arcuate, both stipe and lamina devoid of long bristle-like hairs; stipe 3 to 6 mm. long, 0.2 to 0.3 mm. thick, narrowly greenish marginate from a dark brown base; lamina linear, 2 to 4 cm. long, 2 to 3 mm. broad, throughout very obliquely pinnatifid almost to the rachis, glabrous above, a few appressed short turgid 3 or 4-celled gland-like hairs borne along the rachis beneath and upon the stipe; segments 7 to 16 pairs, alternate, the lower ones mostly sterile, narrowly deltoid-oblong, distant, long-decurrent, the fertile (monosorous) segments of the middle and upper lamina similar but closer, contiguous to slightly imbricate, arcuately oblong from a broadly adnate base, rounded-obtuse, often emarginate upon the distal margin above the sorus, then subspatulate; veins of the sterile segments mostly simple, terminating in a small but distinct dark hydathode (this equidistant from the three sides of the apex of the segment), or rarely forked at an acute angle just below the middle; veins of the fertile segments mostly simple, the sorus borne near the middle of the vein, the receptacle usually evident as a protuberance upon the upper side; sori round or suborbicular, less than 1 mm. in diameter, spreading against the rachis, distinct, or confluent only at maturity; annulus consisting of 14 or 15 cells; spores subglobose, very minutely roughened. Leaf tissue rigidly coriaceous, not at all translucent.

Type in the U. S. National Herbarium, no. 534909, collected in the Serra de Caraça, Minas Geraës, Brazil, March, 1892, by Ule; transmitted by Dr. H. Christ as *Polypodium setosum* Mett., which is *P. micropteris* C. Chr.

*Polypodium perpusillum* has little in common with *P. micropteris* and may be distinguished immediately not only by the shape of the lamina and of the segment but by the complete absence of bristle-like hairs. It is more nearly allied to the West Indian *P. grisebachii* Underw.; but that species differs widely in its rhizome scales, its flexuous rachis, its delicate, translucent leaf tissue, and its less oblique and broader, differently shaped segments, and especially in the position of its sori, these borne at or near the end of sharply defined slender branches.



***Polypodium shaferi* Maxon, sp. nov.**

PLATE 13, B.

Plants very small, the fronds several, ascending or subrosulate. Rhizome suberect, 5 mm. long, less than 2 mm. in diameter, much thicker from the presence of numerous rootlets and the bases of old fronds; scales of the rhizome inconspicuous, densely tufted, 1 to 1.5 mm. long, linear-oblong to oblong-lanceolate, attenuate, attached just above the rounded or subtruncate base, copiously long-ciliate (the cilia about 15 upon each side, close, averaging about 0.25 mm. long, very slender, whitish-hyaline, spreading, often curved), 7 to 9 cells broad near the base, the cells mostly elongate, irregularly polyhedral, the partition walls very dark reddish brown, greatly thickened, in the apical part of the scale often broader than the narrow lumen; stipe obsolete or wanting; lamina usually linear-oblongate, 1.5 to 3.5 cm. long, 2.5 to 4 (rarely 5) mm. broad, pinnately lobed about half way to the rachis, decidedly herbaceous-coriaceous, at first rather freely clothed above with stiff ascending simple yellowish hairs, these less than 0.5 mm. long, fragile and subpersistent, the under surface more freely pubescent, the hairs longer, paler, softer, and spreading; lobes or segments monosorus, 5 to 12 pairs below the obtuse crenate apex, oblique, rounded-deltoid, entire, mostly about 2 mm. broad at the base, the lower ones gradually shorter and broader, the lowermost pair evident only as low crenations, these long-decurrent (2 to 4 mm.) to the base of the frond; veins mostly forked at an acute angle in their lower third, the proximal branch fertile below its tip; sori roundish, about 1 mm. in diameter, extending against the rachis, confluent at maturity; sporangia freely long-setose, the hairs simple; annulus with about 13 cells; spores immature.

Type in the Underwood Fern Herbarium, New York Botanical Garden, collected from among moss on roots and rocks near Camp La Gloria, south of Sierra Moa, Province of Oriente, Cuba, December 24 to 30, 1910, by J. A. Shafer (no. 8071). Duplicate specimens of this collection are in the U. S. National Herbarium.

*Polypodium shaferi* finds its nearest ally unquestionably in *P. mitchellae* Baker, a species described from British Honduras, but now known also from Nicaragua and Guatemala<sup>1</sup> and, according to Christ, from Costa Rica.<sup>2</sup> It resembles that species in the cut of its fronds, in certain characters of its rhizome scales, and in its long-setose sporangia. It is very distinct specifically, however, in its lesser size, its coriaceous texture, its fewer, shorter, and broader lobes, its larger rhizome scales, and in the character and disposition of its pubescence. Young fronds in particular show many stiffish hairs upon the whole upper surface of the frond, whereas in *P. mitchellae* the pubescence of the upper side is almost confined to the midvein and is more sparse, the hairs longer, and much more slender.

The sharpest distinction between these two species, however, is observed in their rhizome scales; for, while the scales of both have numerous long, whitish cilia and are further similar in their greatly thickened, dense partition walls, they are wholly different in shape and size. The scales of the smaller species, *P. shaferi*, are elongate-oblong or oblong-lanceolate and measure from 1 to 1.5 mm. long. Those of the larger species, *P. mitchellae*, are minute (about 0.5 mm. long) and are either broadly deltoid or deltoid-ovate. These differences are very clear.

*Polypodium shaferi* and *P. mitchellae* are related to two South American species, *P. organense* (Gardn.) Mett. and *P. schenckii* Hieron. The last two have their rhizome scales similarly whitish-ciliate and with dark, greatly thickened partition cell walls; their sori, however, are not setose and the fronds of both are very unlike those of the two North American species in general appearance. Hieronymus, in describing *P. schenckii*, placed it in the small group of *P. serrulatum* Mett. (*P. duale* Maxon), but upon what possible ground it is hard to surmise. See page 406.

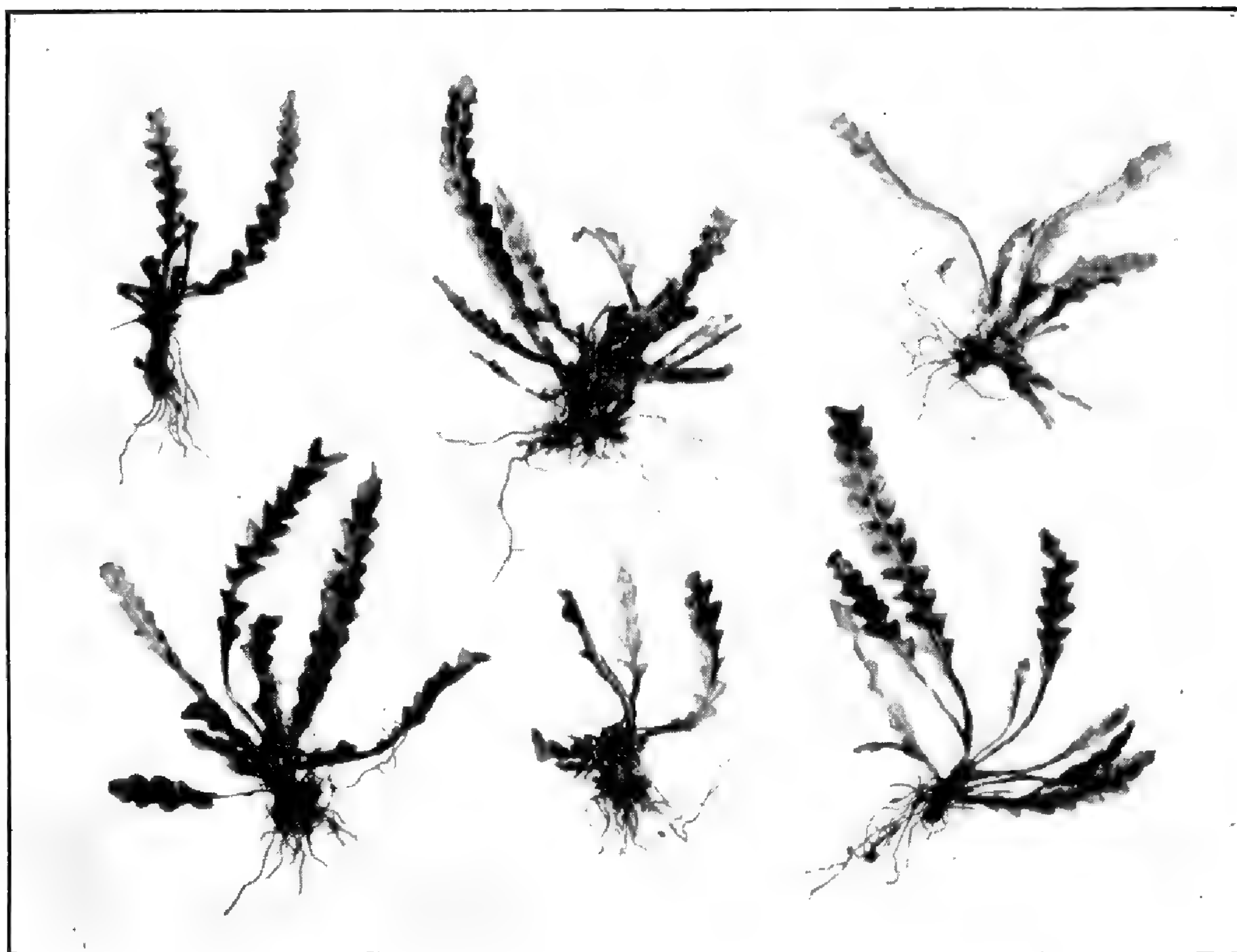
EXPLANATION OF PLATES 13, 14.—Plate 13, type specimens of (A) *Polypodium perpusillum* Maxon and (B) *Polypodium shaferi* Maxon. Natural size. Plate 14, specimens of *Polypodium mitchellae* Baker, collected near Secanquim, Alta Verapaz, Guatemala, altitude 450 meters, on mossy trunk of forest tree, January 7, 1905, by William R. Maxon and Robert Hay (no. 3195). Natural size.

<sup>1</sup> Contr. U. S. Nat. Herb. 13: 43. 1909.    <sup>2</sup> Bull. Soc. Bot. Genève 1: 217. 1909.



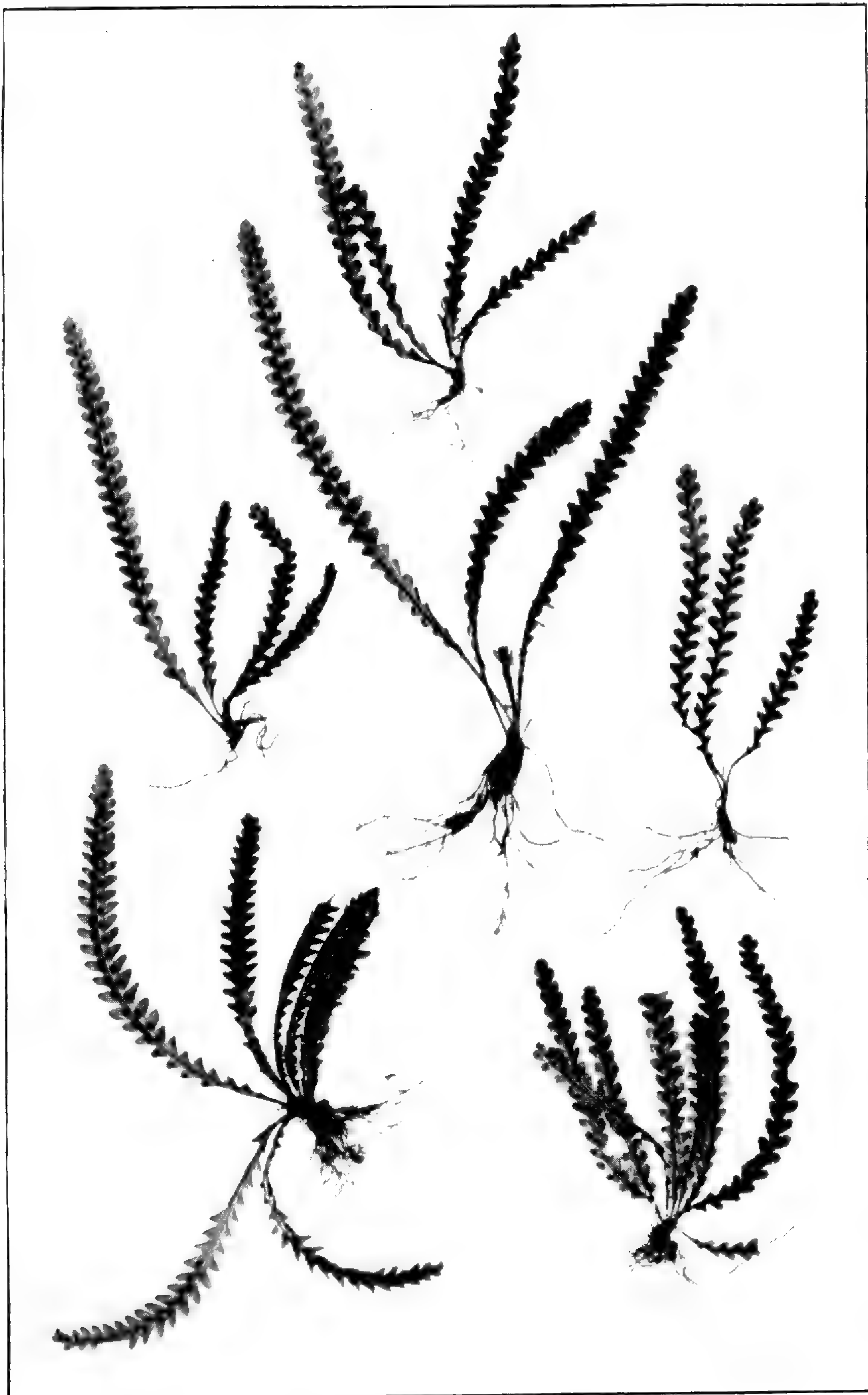


A. *POLYPODIUM PERPUSILLUM* MAXON.



B. *POLYPODIUM SHAFERI* MAXON.





POLYPODIUM MITCHELLAE BAKER.



***Polypodium rosenstockii* Maxon, sp. nov.**

Plants epiphytic, with 8 to 12 pendent fasciculate fronds, 15 to 40 cm. long. Rhizome erect or oblique, 1 to 1.5 cm. high, about 5 mm. in diameter, freely radicle below, the whole upper half conspicuously paleaceous, the scales yellowish brown (bright brown in mass), linear, rather lax, up to 6 mm. long, semitranslucent, sub-tortuous, somewhat plicate, the margins subentire, bearing an occasional minute unicellular gland-like process; stipes 1 to 3 cm. long, 0.5 to 0.7 mm. thick, dull light brown, terete, bearing a few very slender yellowish hairs about 2 mm. long, these readily deciduous; lamina oblanceolate (in small plants) to linear, 12 to 38 cm. long, 2 to 3.2 cm. broad, subpinnatisect throughout, gradually attenuate toward the base, usually more abruptly so toward the short-caudate apex; pinnules 15 to 65 pairs entire, spreading or slightly oblique, the lowermost ones very broadly so, short-decurrent, almost vestigial, often far apart; pinnules in general narrowly triangular-oblong, slightly decurrent to the narrowly acute sinus, connected by a costal wing less than 1 mm. broad; midvein slightly flexuous, medial except at the arcuate base, here parallel to the lower margin; veins 8 to 12 pairs, very oblique, wholly immersed, evident only by transmitted light, mostly once forked at or beyond their middle; sori 7 to 10 pairs, superficial, terminal upon the short distal branches, much nearer to the margin than to the midvein, round, about 1 mm. in diameter; sporangia glabrous, the annulus with 14 cells; spores triplanate, pale, minutely granulate. Leaf tissue very rigidly spongiose-herbaceous, freely but minutely viscid-glandular beneath, sparingly so above.

Type in the U. S. National Herbarium, no. 692068, collected near Caldas, Minas Geraës, Brazil, in 1851 and distributed as no. 1442 of Series III of the Regnell Herbarium under the name *Polypodium pendulum* Swartz.

The following additional collections, both representing younger but fully fertile plants and both distributed as *P. pendulum*, are in the U. S. National Herbarium.

BRAZIL: Serra do Mar, São Paulo, alt. 1,000 meters, *Wacket* (Rosenstock, nos. 288 and 439.)

Although the type number of this species was distributed long ago as *Polypodium pendulum* Swartz and was subsequently listed under that name,<sup>1</sup> it can scarcely be regarded as a near relative of that species, which may be identified readily by means of Schkuhr's excellent plate<sup>2</sup> and Jenman's very good description.<sup>3</sup> *Polypodium pendulum*, which is probably confined to the West Indies, differs wholly in its slender, lax, delicate fronds, short, distant pinnules, rigidly long-setose sporangia, and long-ciliate, conspicuously reticulate rhizome scales.

*Polypodium rosenstockii* is allied rather to *P. curvatum* Swartz, which differs specifically in the much greater size of all its parts, in its exstipitate fronds, in its thicker and decidedly whitish pulverulent leaf tissue, and in its rigidly short-ciliate rhizome scales, as well as in numerous other characters.

Both *P. pendulum* and *P. curvatum* are represented in the National Herbarium by very complete material which was collected by the writer in Jamaica, the type locality, and was compared with Swartz's types at Stockholm by Dr. Lindman. The latter species was described and figured by Fée as *Polypodium inaequale* Fée.<sup>4</sup>

**NOTE UPON PELLAEA ARSENI.**

This species, described<sup>5</sup> by Christ from a single collection (*Arsène* 2496), is a common one in Mexico, whose distinctness had long been recognized by Dr. L. M. Underwood and the writer, independently

<sup>1</sup> Arkiv Bot. 1: 231. 1903.

<sup>2</sup> Krypt. Gewächse 1: pl. 10. 1804.

<sup>3</sup> Bull. Bot. Dept. Jamaica II. 4: 118. 1897.

<sup>4</sup> Mém. Foug. 11: 47. pl. 12. f. 3. 1866.

<sup>5</sup> Not. Syst. 1: 233. 1910.



of each other. In fact, a considerable number of specimens collected by Dr. Edward Palmer and Dr. J. N. Rose had been distributed under another manuscript name given by the writer in honor of the latter. Of the earlier collections by other botanists some were distributed as *Cheilanthes microphylla* Swartz and others as *Pellaea seemanni* Hook. The resemblance of *Pellaea arsenii* to certain states of the former species is rather pronounced; but it bears little likeness to *P. seemanni*, with which, however, it apparently often grows immixed.

The following specimens, all from Mexico, are in the U. S. National Herbarium:

FEDERAL DISTRICT: Valley of Mexico, *Schaffner* 96, 97. Near Guadalupe, *Rose & Painter* 6531. Near Tlalpam, *Rose & Painter* 6463, 9463, 11039. Lava fields near Tlalpam, *Pringle* 9284, 11271.

QUERÉTARO: Near San Juan del Río, *Rose, Painter & Rose*, 9505. Near Querétaro, *Rose & Rose* 11177.

JALISCO: Near Chapala, *Rose & Painter* 7668. Río Blanco, *Edw. Palmer* 732 in 1886.

DURANGO: Otinapa, *Edw. Palmer* 356 in 1906. Tejamén, *Edw. Palmer* 507 in 1906. Vicinity of Durango, *Edw. Palmer* 551 in part, 887, 888, all in 1896.

CHIHUAHUA: Dry rocky slopes, Sierra Madre, *Pringle* 1443. Without special locality, *Edw. Palmer* 87 in 1885.

OAXACA: Near San Luis Tultitlanapa, Puebla, near Oaxaca, *Purpus* 3148.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 979.

### A NEW PSILOGRAMME FROM PORTO RICO.

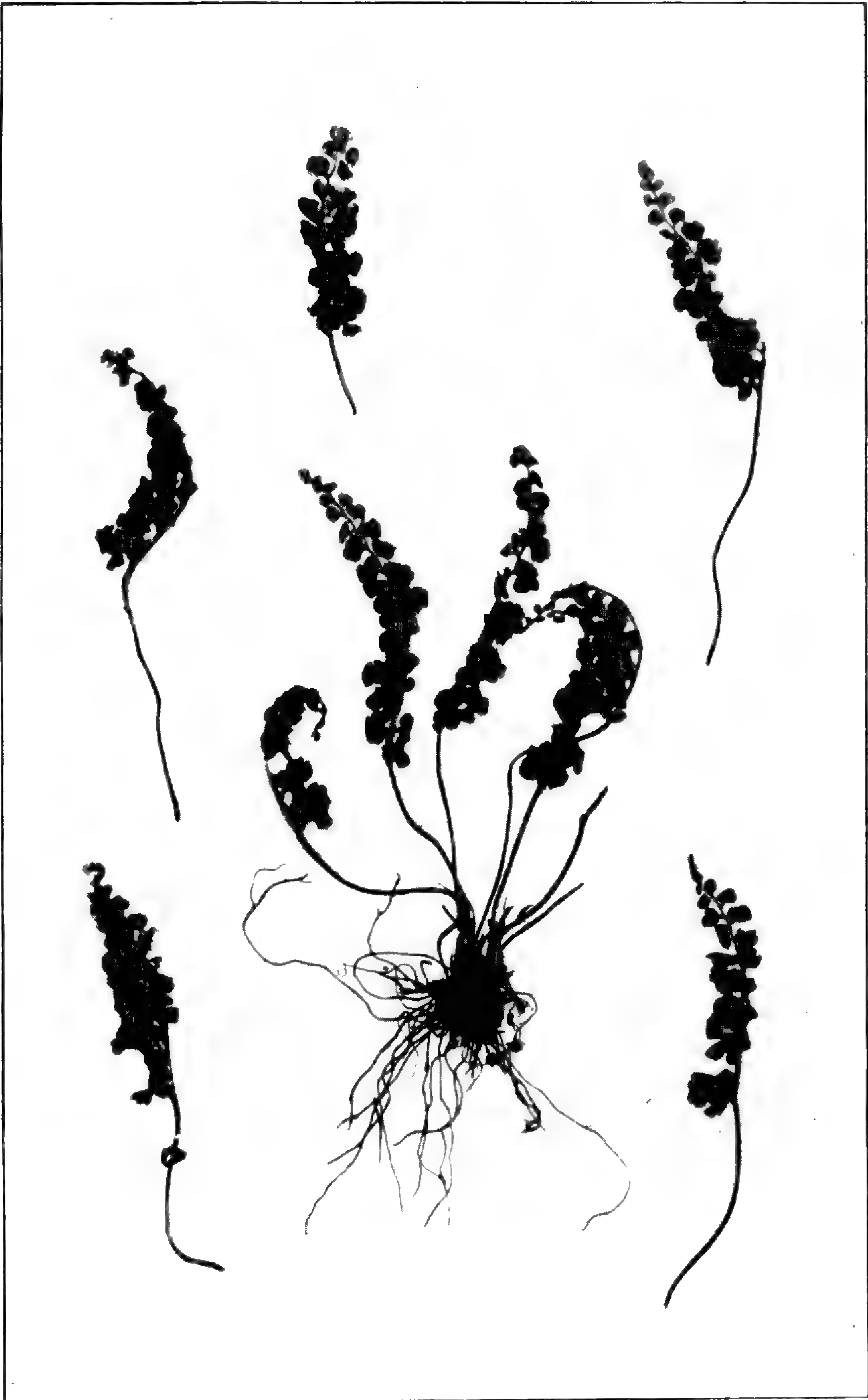
Among a small collection of ferns received from Porto Rico not long ago is the following undescribed species of *Psilogramme*, a genus not reported hitherto from the West Indies.

*Psilogramme portoricensis* Maxon, sp. nov.

PLATE 15.

Plants small, not more than 7 or 8 cm. high. Rhizome erect, about 8 mm. high, 5 mm. in diameter, coarsely radicle below, the apex bearing numerous straight, turgid, sharply acicular, dark castaneous, 12 to 18-celled hairs 1.5 to 2 mm. long; fronds 6 or 8, erect or ascending, arcuate or subflexuose, long-stipitate, 5 to 7 cm. long; stipe 2.5 to 3.5 cm. long, 0.5 to 0.8 mm. thick, dark castaneous, convex dorsally, deeply sulcate ventrally, at the base bearing a few hairs like those of the rhizome, above this densely hispid with flaccid few-celled simple yellowish brown hairs, these subpersistent; lamina lanceolate, acuminate, 2.5 to 3.5 cm. long, 9 to 14 mm. broad in the lower half, subbipinnate in the basal part, the dark rachis clothed like the stipe, the rigidly herbaceous segments strongly hispid upon both surfaces with greenish stramineous, stiffish, flattish, spreading, few-celled hairs; pinnae about 7 to 9 pairs below the acuminate simply lobate apex, the lowermost 2 or 3 pairs deltoid, ternately divided, the two basal segments nearly free, orbicular-obcordate, crenate, the terminal segment larger, asymmetrical, irregularly lobed, the lobes crenate; upper pinnae asymmetrical, broadly oblong to suborbicular, with a single rounded adnate basal auricle upon the distal side, or the uppermost ones simple; veins dichotomous, 2 to 6 ultimate branches to each segment, terminating far from the margin, sporangiate nearly throughout their length, the sori thus linear, confluent at maturity and partially concealed by the widely concave margins of the segments; spores triplanate, rounded-triangular, granulate, with a single wide smooth wing; annulus consisting of 18 or 19 cells.





PSILOGRAMME PORTORICENSIS MAXON.





HEMITELIA RUDIS MAXON.



Type in the U. S. National Herbarium, no. 697769, collected at the extreme summit of El Yunque Mountain, Porto Rico, altitude about 1,110 meters, March, 1912, by Brother Hioram (no. 348).

This new member of the genus *Psilogramme* is one of a small group of species in which the veins do not reach the margin, and of a still smaller section characterized by having several veinlets to each ultimate segment. Out of the 4 or 5 species comprising this last subgroup it is related at all closely only to *P. hispidula* (Klotzsch) Kuhn, a South American species which is known to the writer from Kunze's illustration<sup>1</sup> and a single Colombian specimen in the U. S. National Herbarium. *Psilogramme portoricensis* is about one-third the size of *P. hispidula* and differs widely otherwise in the shape and subdivision of its pinnæ and in its much more copious hispid covering throughout, particularly upon the lamina.

EXPLANATION OF PLATE 15.—Type specimens of *Psilogramme portoricensis*. Natural size.

## A NEW SPECIES OF HEMITELIA, SECTION CNEMIDARIA, FROM PANAMA.

A further examination of material collected in Panama has led to the conclusion that the form here described is entitled to recognition as distinct from the species previously treated by the writer in a revision of the North American species of *Hemitelia*, section *Cnemidaria*.<sup>2</sup> Its relationship is discussed below.

***Hemitelia rudis* Maxon, sp. nov.**

PLATE 16.

Rhizome short, erect, mostly subterranean; fronds several, erect-spreading, 2 to 2.5 meters long; stipes stout, about 80 cm. long, deeply sulcate, pale brownish, closely arachnoid-furfuraceous, distantly and sharply low-tuberculate, scantily paleaceous, the scales deciduous, appressed, with glossy dark brown centers and broad whitish fimbriate margins; lamina 1.2 to 1.7 meters long, 60 to 80 cm. broad, oblong-lanceolate, deeply bipinnatifid, the rachis similar to the stipe but not tuberculate; pinnæ about 17 pairs below the abruptly acuminate apex, subopposite or mainly alternate, inserted 7 to 13 cm. apart on each side, the larger ones linear-lanceolate, 30 to 40 cm. long, 5 to 8.5 cm. broad, sessile, spreading, scarcely or not at all reduced at the inequilateral base, at the lower side rounded and often slightly imbricate upon the rachis, at the upper side parallel to the rachis, pinnatifid to within 2 or 3 mm. of the costa in the basal part, the costal wing broader outward, about 5 mm. broad on each side below the gradually long-acuminate, often attenuate apex; costæ stout, together with the costules deciduously arachnoid-pubescent beneath and bearing occasional appressed broad flattish delicate pale scales; segments of middle pinnæ 20 to 25 pairs, linear-oblong, acuminate to long-acuminate, slightly dilatate, 7 to 14 mm. broad, approximate to distinctly apart, falcate or subfalcate, coarsely crenate-serrate, the subimbricate proximal basal segment usually lobed upon the proximal margin; veins all free, evident, glabrous above, distinctly setulose beneath, once or twice forked, or the larger ones with 2 or 3 pairs of subopposite arcuate lateral branches; sori approximate, mostly inframedial, borne upon the lower branches of the veins at or near their base, or rarely submedial by the production of an imperfect second row upon the second row of branches; indusium rather small, semicircular, subcucullate or repand, crenately lobed, fragile; receptacle ovoid, minutely pubescent. Leaf tissue rigidly herbaceous, dark green above, much lighter below.

Type in the U. S. National Herbarium, nos. 670388-391, consisting of a single frond taken from a plant growing in the humid forest of the upper Caldera watershed,

<sup>1</sup> Kunze, Farnkr. 1: pl. 82. 1846.    <sup>2</sup> Contr. U. S. Nat. Herb. 16: 25-49. 1912.



between "Camp I" and the Divide, Holcomb's trail, above El Boquete, Chiriqui, Panama, altitude about 1,750 meters, March 23, 1911, by William R. Maxon (no. 5682). Additional data are derived from other mounted specimens of the same number.

In the venation of its largest pinnæ *Hemitelia rudis* shows some approach to *H. grandis*, though it differs from that species conspicuously in leaf shape, in its much lesser size and degree of subdivision, and in its crenate-serrate (not crenately lobed) segments. It is more nearly related to *H. subglabra* of Costa Rica, but differs in venation and in its coarsely crenate-serrate (instead of subentire to lightly undulate-serrate) margins. The deeply lobed proximal basal segments, overlying the rachis, recall the West Indian *H. grandiflora*,<sup>1</sup> a species with which it has no close connection.

EXPLANATION OF PLATE 16.—Basal portion of a pinna of the type collection. Natural size.

## THE NORTH AMERICAN SPECIES OF HEMITELIA, SECTION EUHEMITELIA.

In a previous paper<sup>2</sup> of this series the writer, in the course of a brief review of the taxonomic history of *Hemitelia*, expressed the view that two fairly distinct sections of the genus might properly be recognized: "(1) *Euhemitelia* and (2) *Cnemidaria*; the first, embracing large species of truly arboreous growth, with mainly tripinnatifid fronds and narrow, often rather minute segments; the latter, plants which are scarcely arborescent, with ample, pinnate to bipinnatifid (or rarely tripinnatifid) fronds, the leafy parts broad and little dissected."

The North American species of the section *Cnemidaria* were treated in that paper, eight out of the eighteen there recognized being described as new. There were included also notes upon three species known only from South America and comments upon five doubtful species described long ago from various parts of tropical America. In the present paper the North American representatives of the typical section of the genus, *Euhemitelia*, will be similarly treated. The type species is *H. multiflora* (J. E. Smith) R. Br.

It must be admitted that *Euhemitelia* is not an especially homogeneous group and that, leaving the indusia out of consideration, its species might be placed in either *Cyathea* or *Alsophila* without great violence. Having regard to the indusia, moreover, a close interrelationship of its species is even less evident, since this structure has assumed several very diverse forms. Thus, although *Hemitelia multiflora* shows indusia very like those of the species of section *Cnemidaria*, other species (for example, *H. sessilifolia*, *H. sherringii*, and *H. muricata*) have the indusia deeply cleft and more or less perfectly deciduous, and in *H. costaricensis* the subdivision is carried even further. On the other hand, *Hemitelia wilsoni* has more than a few of its indusia of a subcyathiform type; that is, extending more

<sup>1</sup> See Contr. U. S. Nat. Herb. 16: 41. 1912.

<sup>2</sup> Contr. U. S. Nat. Herb. 16: 26. 1912.



than halfway around the base of the receptacle and nearly forming a shallow cup, thus approaching the form which distinguishes several of the species of *Cyathea*, section *Eucyathea*. The transition from a delicate, fragile, deeply splitting indusium like that of *Hemitelia muricata* to the mere vestigial scale observed in the Jamaican *Alsophila parvula* and the Australasian *Alsophila australis* (which is the type species of *Alsophila*), and further to the complete absence of even a vestigial scale, is not a very great step, and there are several species whose ready reference to one genus or the other requires good material. Whether there is warrant for giving so much weight to indusium characters in the distinction of the genera is open to question. The writer, as heretofore explained, has preferred to follow the usual practice. In any case these characters are fairly constant for the species and upon careful examination are very useful in distinguishing them.

## KEY TO THE SPECIES.

Lamina bipinnate, the pinnules serrate-crenate to barely pinnatifid.

Pinnæ 20 to 24 cm. long; pinnules deeply serrate-crenate.... 1. *H. elliotii*.

Pinnæ 40 to 60 cm. long; pinnules mostly pinnatifid about halfway to the costa.

Indusia brown, dimidiate, deeply lacerate-fimbriate, the divisions slender, fragile, fugacious..... 2. *H. sessilifolia*.

Indusia much larger, whitish, saccate or subcylindrical, subentire or shallowly lobed, persistent..... 3. *H. wilsoni*.

Lamina very deeply tripinnatifid.

Sori inframedial, often borne close to the costa.

Segments 12 to 14 pairs, distant, the sinuses obtuse..... 4. *H. sherringii*.

Segments 20 to 23 pairs, approximate, the sinuses sharply acute.

Indusia conspicuous, bullate, erose or shallowly cleft. 5. *H. calolepis*.

Indusia obscure, deeply cleft, the divisions lacerate to filamentous..... 6. *H. costaricensis*.

Sori medial or distinctly supramedial.

Larger pinnules about 13 pairs per pinna..... 7. *H. escuquensis*.

Larger pinnules 18 to 25 pairs per pinna.

Indusia small, shallowly lobed, persistent..... 8. *H. multiflora*.

Indusia large, very deeply cleft into several long slender segments, these fugacious..... 9. *H. muricata*.

1. *Hemitelia elliotii* (Baker) Underw. MS.

*Alsophila elliotii* Baker, Annals of Botany 6: 96. 1892.

Caudex said to be very short; fronds 90 to 120 cm. long; stipe 30 cm. long, armed with spreading sharp spines, divested of scales with age; lamina subdeltoid, 60 to 90 cm. long, bipinnate, the primary rachis mottled reddish brown, slightly rough, glabrescent; pinnæ narrowly oblong-lanceolate, 20 to 24 cm. long, 5 to 6 cm. broad, subsessile, long-acuminate, the secondary rachis stout, reddish, distantly muricate, glabrescent, very delicately and inconspicuously foliaceo-marginate except at the base; pinnules about 20 pairs, linear-oblong, 2.5 to 3 cm. long, 7 to 9 mm. broad, deeply serrate-crenate, approximate to subdistant, sessile, or those toward the apex semiadnate, the apical ones fully adnate and decurrent; costules stout, elevated,



bearing an occasional distant flattish or subbullate pale brownish scale; major veins about 8 pairs per pinnule, each with 3 to 5 pairs of simple oblique branches to each crenation, the lowermost pair of branches extending to the sinus; sori very few, small, medial; indusium proximal, small, dimidiate, light brown, somewhat erose; receptacle minutely squamulose-pilose.

TYPE LOCALITY: Antoine, Bellevue, Grenada (*Elliott*).

DISTRIBUTION: Known only from the mountains of Grenada.

*Hemitelia elliottii* is here redescribed chiefly from a specimen so named in the Jenman collection (acquired by the New York Botanical Garden in 1903) and marked as coming from Grenada, the collector's name not specified. The general appearance of the plant, its smaller size, and its nearly sterile condition all lead to the suspicion that it may be a juvenile form of some other species. There is, however, no hint of identity with *Hemitelia wilsoni* Hook., to which species it was referred by Jenman.<sup>1</sup> In the character of its few scales it suggests relationship with *Hemitelia sessilifolia*, but it is more likely to prove a reduced or juvenile form of some South American species.

**2. *Hemitelia sessilifolia* Jenman, Ferns Brit. W. Ind. Guian. 44. 1898. PLATE 17.**

*Alsophila sessilifolia* Jenman, Journ. Bot. 20: 325. 1882.

TYPE LOCALITY: Mansfield, near Bath, Jamaica (*Wilson* 520).

DISTRIBUTION: Known only from the original collection.

The specimens upon which this species was described are preserved at Kew and in the British Museum. The writer has received from the latter institution a photograph and pinnule of the type and has examined two additional complete specimens in the Underwood Fern Herbarium, New York Botanical Garden, apparently of the original collection by Wilson. These indicate a species similar to the larger states of *Hemitelia wilsoni* in cut of leaf, but differing in the characters noted under that species. Jenman, though listing and describing *sessilifolia* as distinct from *wilsoni*, nevertheless states that "it is probably a non-indusiate state of *wilsoni* Hook., which it very much resembles in the largest states." *Hemitelia sessilifolia* is not, however, non-indusiate. The indusia, as made out from a pinna of the type collection preserved in Jenman's own collection (since acquired by the New York Botanical Garden), have been described by the writer (in manuscript for the North American Flora) as "brown, proximal, dimidiate, deeply lacerate, the divisions fimbriate, fragile, only the broader basal portions usually persistent, or these tardily deciduous." They are thus very different from the indusia of *H. wilsoni* but not very unlike those of *H. muricata*, a species which is not closely allied to it.

EXPLANATION OF PLATE 17.—Section of a primary pinna in Underwood Fern Herbarium, collected by Wilson and apparently a part of the original collection. Natural size.

**3. *Hemitelia wilsoni* Hook. in Hook. & Baker, Syn. Fil. 30. 1865. PLATE 18.**

TYPE LOCALITY: Mansfield, near Bath, Jamaica (*Wilson* 731).

DISTRIBUTION: Mountains of Jamaica and Porto Rico, at 300 to 900 meters altitude; rare.

The present species is one of the most peculiar tree ferns of the West Indies and probably one of the rarest. It was first collected by Wilson in some part of eastern Jamaica near Mansfield, a region which has yielded several other new and as yet little known species of Cyatheaceae. According to Jenman it has since been collected in Jamaica by Syme, Sherring, and Hart near Mount Moses and Claverty Cottage. Jenman includes Grenada in its range also, but the specimens so referred appear to represent a distinct species, *Hemitelia elliottii*, described by Baker.

The relationship of *Hemitelia wilsoni* is with *H. sessilifolia*, but it differs somewhat in cut of leaf and very noticeably in its large whitish (not lacerate nor brownish) indusia, as well as in its rather numerous, large, subpersistent, flat, appressed, whitish

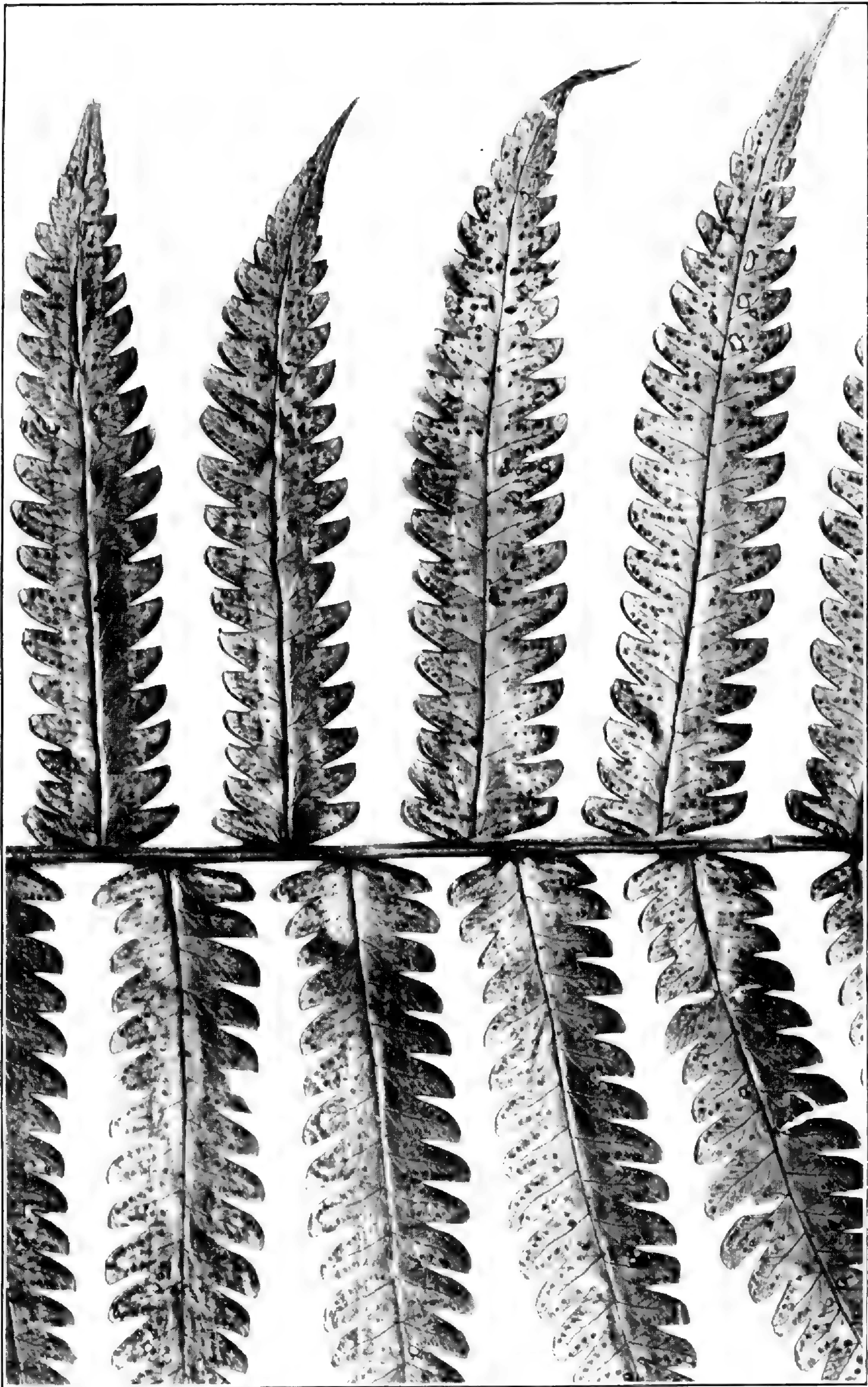
<sup>1</sup> Ferns Brit. W. Ind. Guian. 44. 1898.





HEMITELIA RUDIS MAXON.





HEMITELIA SESSILIFOLIA JENMAN.





HEMITELIA WILSONI HOOK.





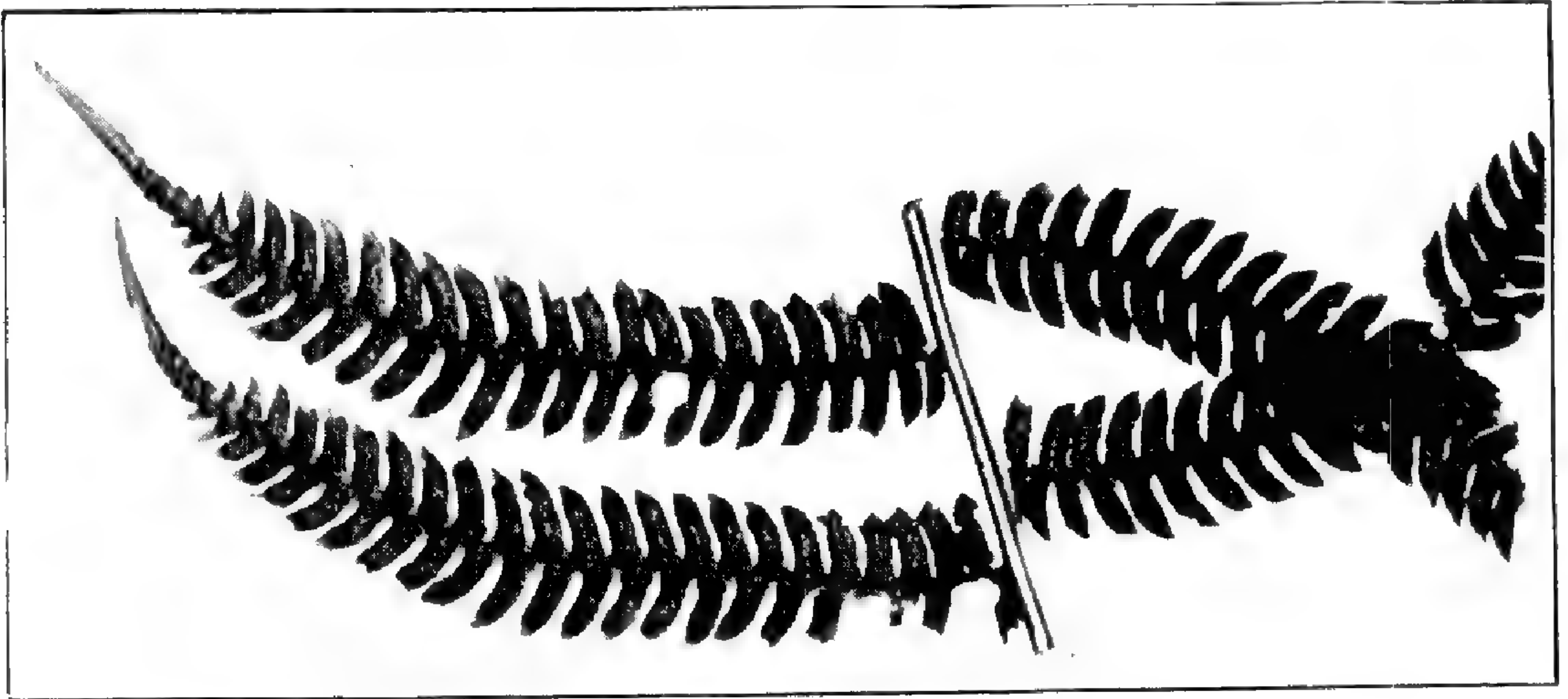
HEMITELIA SHERRINGII JENMAN.



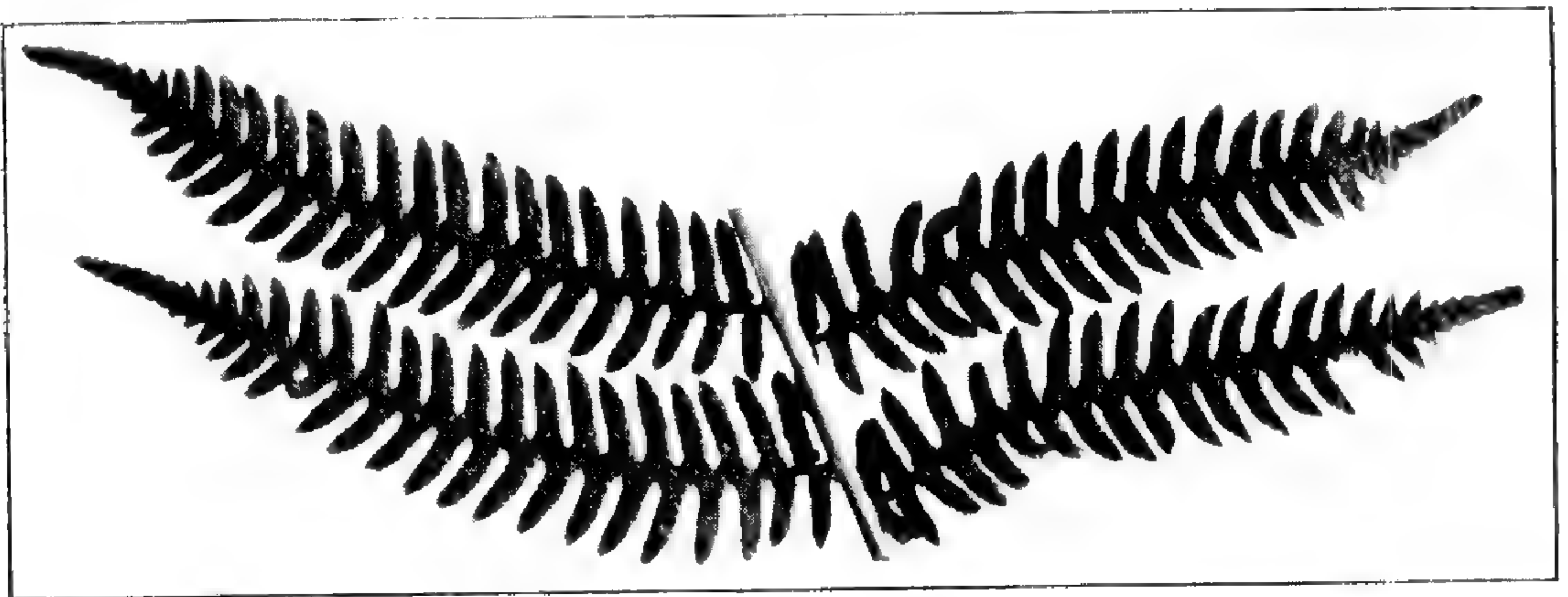


HEMITELIA CALOLEPIS HOOK.

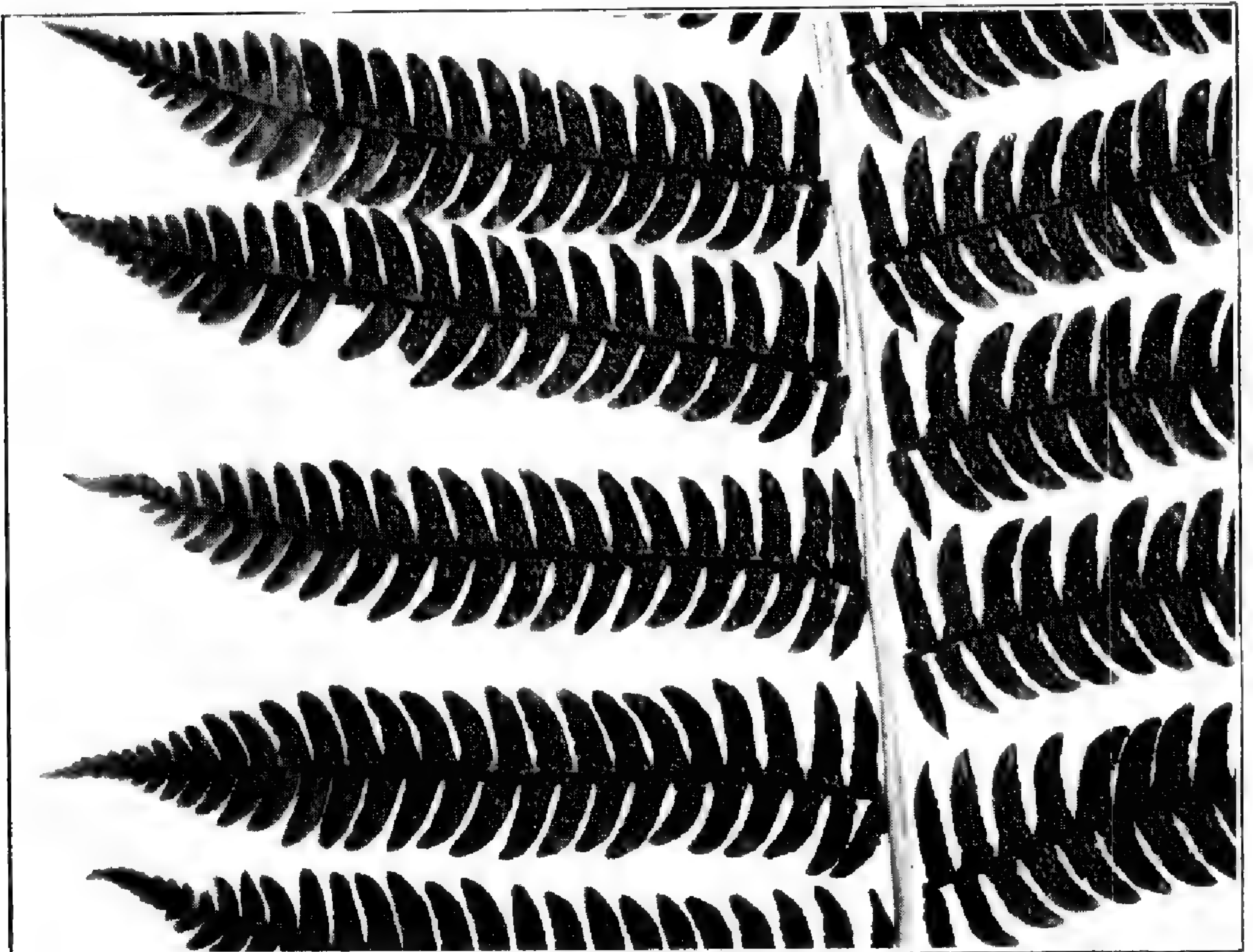




A. *HEMITELIA COSTARICENSIS* (KLOTZSCH) METT.



B. *HEMITELIA COSTARICENSIS* (KLOTZSCH) METT.



C. *HEMITELIA COSTARICENSIS* (KLOTZSCH) METT.



scales upon the under side of the costæ. The few scales which occur similarly in *Hemitelia sessilifolia* are small and brownish.

The Porto Rican record, which is a new one, relates to specimens collected at Finca Alvarez, January 4, 1913, by Brother Hioram (no. 182). These are unusual in showing a short transverse veinlet occasionally connecting the lowest vein of each group to a similar vein of the next. This feature is not evident in Jamaican specimens, of which there are several in the Underwood Fern Herbarium, collected by Wilson, and two in the National Herbarium, the collector's name of the latter not given. These accord perfectly with a fragment of the type in the D. C. Eaton Herbarium and with a photograph of the type, received from Kew.

EXPLANATION OF PLATE 18.—Basal section of a primary pinna in the Underwood Fern Herbarium collected by Wilson and presumably a part of the original collection. Natural size.

**4. *Hemitelia sherringii* Jenman, Journ. Bot. Brit. & For. 24: 266. 1886. PLATE 19.**

TYPE LOCALITY: Rose Hill, Port Royal Mountains, Jamaica, altitude about 1,200 meters.

DISTRIBUTION: Known only from the type locality.

According to Dr. L. M. Underwood's unpublished notes this species is known only from a single plant, growing in the Port Royal Mountains, Jamaica, from which Mr. R. V. Sherring collected specimens in 1886. Pinnæ of this collection are at Kew, in the Underwood Fern Herbarium of the New York Botanical Garden, and in the U. S. National Herbarium.

EXPLANATION OF PLATE 19.—Portion of a pinna of the type collection, in the U. S. National Herbarium. Natural size.

**5. *Hemitelia calolepis* Hook. in Hook. & Baker, Syn. Fil. 29. 1865. PLATE 20.**

TYPE LOCALITY: Monte Verde, Province of Oriente, Cuba.

DISTRIBUTION: Known only from the original collection (*Wright* 950).

A strongly marked species somewhat suggesting certain lax states of *Cyathea arborea*. The small roundish, whitish, bullate scales, which occur sparingly upon the costæ and abundantly upon the costules, are characteristic. Specimens of the original collection have been examined in several herbaria.

EXPLANATION OF PLATE 20.—Section of primary pinna in herb. D. C. Eaton. Natural size.

**6. *Hemitelia costaricensis* (Klotzsch) Mett.; Kuhn, Linnaea 36: 159. 1869.**

PLATE 21.

*Cyathea costaricensis* Klotzsch; Kuhn, Linnaea 36: 159. 1869, as synonym.

TYPE LOCALITY: Costa Rica or Veraguas, Panama.

DISTRIBUTION: Vera Cruz to Panama, ascending to 1,000 meters.

Although *Hemitelia costaricensis* shows wide variation in size the differences are no greater than might be looked for in a species covering so wide a range. The original specimens, collected by Warscewicz (nos. 36 and 197) in "Costa Rica and Veragua," have the appearance of being decidedly xerophilous for a tree fern; and it is interesting to note that the Guatemalan specimens cited below are all from the drier, western part of that country and that the Santa Rosa specimens in particular, which in their lesser size perfectly match the original, are from a region which, in fact, may even be called semiarid. Few tree ferns are able to exist in such surroundings.<sup>1</sup> In the more humid region of Vera Cruz, Mexico, individuals of this species are uniformly much larger, the pinnæ up to 70 cm. long and nearly 25 cm. broad, dimensions much greater than those of the specimens just mentioned. All of these are otherwise very similar. The indusium is peculiar in having the large proximal portion deeply cleft into several elongate, lacerate divisions (these with long, tortuous, filamentous apices)

<sup>1</sup> See Maxon, "The tree ferns of North America," Ann. Rep. Smiths. Inst. 1911: 463-491. pl. 1-15. 1912. *Cibotium wendlandi* Mett. is another tree fern showing the same unusual adaptation.



and the smaller distal portion reduced to a few tortuous, spreading, filaments which resemble flaccid paraphyses. The divisions of the indusia appear like a lax scaly covering to fertile portions of the leaf, but sterile segments will be found nearly or quite devoid of scales.

Besides a portion of the type received from Berlin, the following specimens are in the U. S. National Herbarium:

MEXICO: Vallée de Córdoba, December 18, 1865, *Bourgeau* 1454. Córdoba, *Kerber* 36a. Atoyac, *Kerber* 122. Zacuapan, Vera Cruz, in moist shady forests, *Purpus* 3810, 4047, 6194.

GUATEMALA: San Andres Osuna, Dept. of Escuintla, *C. & E. Seler* 2548. Santa Rosa, Dept. of Santa Rosa, alt. 900 meters, *Heyde & Lux* (*J. D. Smith*, no. 3219). Vicinity of San Felipe, Dept. of Retalhuleu, alt. 600 meters, *J. D. Smith* 2718, 2734; *Maxon* 3532. Vicinity of San Francisco de Miramar, Costa Cuca, alt. 1,000 meters, *Pittier* 64.

EXPLANATION OF PLATE 21.—Sections of primary pinnae of, A, the type specimen (received from Berlin); B, a specimen from the dry region of Santa Rosa, Guatemala (*J. D. Smith* 3219); C, a specimen from San Felipe, Guatemala (*Maxon* 3532). All at natural size.

**7. *Hemitelia escuquensis* Karst. Fl. Columb. 2: 181. 1869.**

TYPE LOCALITY: Humid mountains near Escuque, western Venezuela, upon the southern shores of Maracaibo Harbor, altitude 100 meters.

DISTRIBUTION: Known also from Porto Rico.

ILLUSTRATION: Karst. op. cit. 2: pl. 196.

*Hemitelia escuquensis* was described and elaborately illustrated by Karsten from specimens collected by Engel in a district now included in western Venezuela. Aside from this collection the species is apparently known only from Porto Rico, two numbers (4102 and 6156) of Sintenis' specimens from that island being cited by Urban.<sup>1</sup> Of these only 4102 is found in the U. S. National Herbarium, this being represented by two specimens, one of which is unmistakably *Cyathea portoricensis* Spreng. and the other a partially fertile condition of a *Hemitelia* which, in the writer's opinion, is not specifically different from *H. escuquensis*. This opinion is based upon a comparison of the latter with a pinnule of Engel's original specimen, received from Berlin through the courtesy of Dr. Georg Hieronymus. Upon the authority of Doctor Hieronymus, however, the Berlin specimens of nos. 4102 and 6156 represent a single species which (both of the specimens being sterile) can not be referred definitely to the genus *Hemitelia*. They are said by him to be certainly distinct from *H. escuquensis* and it is probable that both appertain to *Cyathea portoricensis*.

The *Hemitelia* element of no. 4102 in the U. S. National Herbarium agrees closely in the more essential minute characters with the type fragment of *H. escuquensis* and with the detailed description by Karsten. It differs mainly in the lesser size of nearly all of its parts and in having the segments less strongly lobed. It has the following data:

PORTO RICO: Adjuntas, in sylva ad Las Cruces, April 2, 1886, *Sintenis* 4102.

**8. *Hemitelia multiflora* (J. E. Smith) R. Br.; Spreng. Syst. Veg. 4: 126. 1827.**

*Cyathea multiflora* J. E. Smith, Mém. Acad. Sci. Turin 5: 416. 1793.

*Amphicosmia multiflora* Gardner, Lond. Journ. Bot. 1: 441. 1842.

*Hemitelia nigricans* Presl, Epim. Bot. 31. 1851.

*Hemitelia hartii* Baker, Journ. Bot. Brit. & For. 24: 243. 1886.

*Alsophila decussata* Christ in Pittier, Prim. Fl. Costar. 3: 41. 1901.

TYPE LOCALITY: "America meridionalis" (*R. Shakespeare*).

DISTRIBUTION: Guatemala to Panama, ascending to 1,100 meters in Costa Rica.

ILLUSTRATIONS: Bull. Torrey Club 38: pl. 35; Ann. Rep. Smiths. Inst. 1911: pl. 10, f. B. 1912.

<sup>1</sup> Symb. Antill. 4<sup>4</sup>: 11. 1903.



The varied nomenclatorial history of this fern, known usually as *Hemitelia nigricans*, was recently discussed at length<sup>1</sup> by the writer, who redescribed the species, published an illustration of a part of the type material, and cited numerous specimens from Guatemala, Nicaragua, Costa Rica, and Panama, where it is apparently a not uncommon species. No recent specimens are known from Jamaica, which was long supposed to be the type locality. A further review of the material at hand leads to the conclusion that, in addition to the species previously reduced to *H. multiflora*, *Hemitelia hartii* Baker, mentioned by the writer as doubtfully distinct, must also be included in that species, a disposition which will necessitate only a slight modification of the writer's previous description.

As thus defined *H. multiflora* shows a considerable breadth of variation in venation, position of sori, and shape of segments. One extreme (the commonest form) is seen in the partially fertile state which has usually been called *H. nigricans*, in which the segments are straight or only subfalcate, the veins about equally simple and once forked, and the sori confined to the lower veins. In such specimens the few sori are distinctly supramedial or even submarginal. In fully fertile fronds (a rare condition, apparently) two variations in form are found: (1) The Costa Rican plants described as *A. decussata*, in which the pinnules are similar in shape to the partially sterile ones mentioned above, but smaller, the veins either simple or once forked, and the sori nearly medial or slightly inframedial; (2) the luxuriant, exceedingly fertile plant described by Baker (from Hart's single Chiriqui collection) as *H. hartii*, in which most of the segments are distinctly falcate and nearly all of the veins once forked and soriferous half way to the margin. In this last form the bullate scales extend sparingly to the veins, a feature noted also in the writer's specimens from Porto Bello, Panama, which otherwise are typically representative of "*H. nigricans*." The whole series shows no greater variability than *Cyathea arborea* and like that species ranges from sea level to upward of 1,000 meters. In all of the specimens the peculiar shape of the tip of the pinnæ, the alate secondary rachises, the nature and disposition of the pubescence, and the characters offered by the scales and spines of the stipe, are constant and indicate only a single variable species.

The record of specimens of *H. hartii* from Colombia doubtless relates to the original collection, Chiriqui having been a part of Colombia at that time. *Hemitelia obscura* Mett. has been referred to *H. nigricans*, that is, to *H. multiflora*; but it is amply distinct, as previously pointed out.

**9. *Hemitelia muricata* (Willd.) Fée, Gen. Fil. 350. 1850-52.**

**PLATE 22.**

*Cyathea muricata* Willd. Sp. Pl. 5: 497. 1810.

*Alsophila muricata* Desv. Mém. Soc. Linn. Paris 6: 319. 1827.

*Disphenia muricata* Presl, Abh. Böhm. Ges. Wiss. V. 5: 349. 1848.

Caudex erect, 4 to 6 meters high, radicose toward the base; fronds 7 or 8, spreading in a wide crown, apparently 2.5 to 3.5 meters long; stipe stout, 2 to 2.5 cm. in diameter, dark castaneous, lustrous beneath a loose furfuraceous covering of minute squamules, densely armed with short straight acicular spines 1 to 3 mm. long; lamina ample, at least 140 cm. broad, deeply tripinnatifid, the rachis castaneous, lustrous, slightly muricate; pinnæ subopposite to alternate, 50 to 70 cm. long, 15 to 21 cm. broad, very abruptly acuminate, the secondary rachis similar to the primary or brownish and freely muricate, lightly furfuraceous; pinnules about 25 pairs, linear-oblong, 8 to 12 cm. long, 1.5 to 3 cm. broad, long-acuminate, distinctly petiolate (2 to 4 mm.), articulate, deciduous, approximate or contiguous, very deeply pinnatifid, the costæ densely and antrorsely strigose above, beneath stoutish, very prominent, castaneous, bearing numerous scattered subbullate brownish or light-castaneous ovate acuminate scales; segments 15 to 17 pairs, oblong to linear-oblong, 8 to 15 mm. long, 4 to 5 mm. broad,

<sup>1</sup> On the identity of *Cyathea multiflora*, type of the genus *Hemitelia* R. Br. Bull. Torrey Club 38: 545-550. pl. 35. 1912.



slightly falcate, acutish, lightly to deeply crenate, the proximal basal one sometimes free, the others connected by a costal wing about 1 mm. broad on each side in the basal part, wider (about 2 mm. broad) toward the apex; costules prominent, glabrous above or bearing a few minute hairs, beneath not pubescent, bearing numerous pointed bullate scales similar to those of the costæ; veins 7 to 10 pairs, oblique, mostly once (rarely twice) forked, glabrous; sori 3 to 6 pairs, large, seated at the fork of the veins, their position evident on the upper surface of the segment by sharp depressions; indusium bright brown, ample, deeply cleft into several long spreading acute segments, these fugacious; receptacle capitate, frequently bipartite with age, setose. Leaf tissue firmly membrano-herbaceous, dull dark green above, lighter below, discolored in drying.

TYPE LOCALITY: Cobstere, Martinique (*Plumier*).

DISTRIBUTION: Apparently confined to Guadeloupe and Martinique, at altitudes of from 400 to 1,100 meters.

ILLUSTRATION: *Plum. Trait. Foug. pl. 4.*

Concerning the identity of this species the writer wrote several years ago<sup>1</sup> as follows:

"*Cyathea muricata* Willd. Sp. Pl. 5: 497. 1810. Founded upon Plumier's plate 4 (*Traité Foug.*), representing a plant from Martinique. Baker, following Kaulfuss, has regarded Sieber's no. 374 from Martinique as agreeing with the plate; but the resemblance is slight. Sieber's plant is a large state of *Cyathea tenera*; and the plant figured by Plumier is, so far as the writer knows, yet to be rediscovered. The *C. muricata* of Grisebach is said by Christensen to be *C. furfuracea* Baker. Costa Rican specimens (*Pittier* 1839) determined by Bommer as "*Cyathea muricata* Willd. (non Kaulf.)" are *Cyathea onusta* Christ."

To these notes it should be added that possibly Sieber's no. 374, above mentioned, may have been a mixture of two or more species, since Presl<sup>2</sup> also regarded his specimen of this number as representing *C. muricata*; but that the specimen of no. 374 at the New York Botanical Garden is, nevertheless, clearly referable to *Cyathea tenera* (J. Sm.) Griseb.

More recently the National Museum has received several specimens collected by Duss in Guadeloupe and Martinique which agree very well with Plumier's plate 4, which was apparently the sole basis of *Cyathea muricata* Willd. These show the characters mentioned in the above description and serve to identify satisfactorily a species which has long been misunderstood, partly from the anomalous character of the indusium, and partly from its rarity, since it seems to be confined to these two islands of the Lesser Antilles. The specimens referred to are:

MARTINIQUE: Bois du Camp Colson, *Duss* 4602 (as *Alsophila aspera?*).

GUADELOUPE: Without locality, *Duss* 4157. Also, two specimens without number, *Duss*.

The agreement of these with Plumier's description and figure is close, particularly as to the general shape of the pinnæ and pinnules and as to the spiny stipes and rachises. The rachises are, however, much less spiny than figured—another instance of exaggeration of details by Plumier's artist. The spiny covering is nevertheless of precisely the type, though not degree, represented in plate 4.

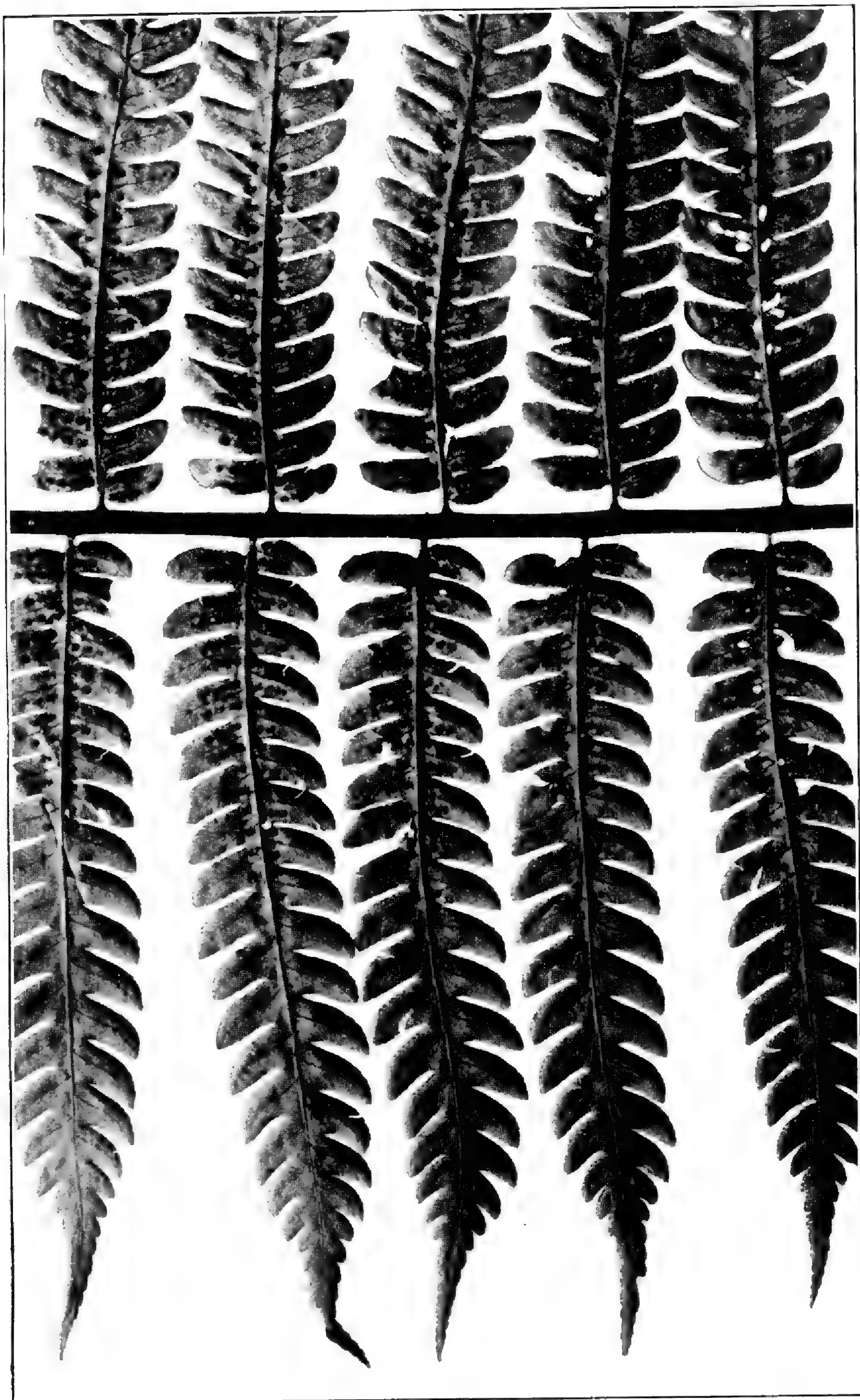
There is at hand also another specimen from Martinique (*Duss* 4600) which is very similar in its rachises (particularly as to armature and color) and in its narrower pinnules. It probably represents a species distinct from *Hemitelia muricata*. Further material of it is much to be desired.

EXPLANATION OF PLATE 22.—Section of a primary pinna of *Hemitelia muricata* from Guadeloupe (*Duss* 4157). Natural size.

<sup>1</sup> N. Amer. Flora 16<sup>1</sup>: 88. 1909.

<sup>2</sup> Abh. Böhm. Ges. Wiss. V. 5: 349. 1848.





HEMITELIA MURICATA (WILLD.) FÉE.



## TWO NEW SPECIES OF MARATTIA FROM PANAMA.

In the North American Flora, volume 16,<sup>1</sup> but six members of the genus *Marattia* are recognized from North America. This number must be increased by the description of the following new species, both collected by the writer in the densely forested, mountainous region of western Chiriqui, Panama.

***Marattia chiricana* Maxon, sp. nov.**

Stipe stout, about 40 cm. long; lamina very large, broadly deltoid, 1.8 meters broad, 1.3 meters long, tripinnate in all but the extreme apical portion; basal pinnae ovate, 95 cm. long, 60 cm. broad at the middle, 40 cm. broad at the anadromous base, long-petiolate (12 cm.), nearly equilateral, comprising (below the short-acuminate, simply pinnate apex) about 8 pairs of mostly opposite, once-pinnate secondary pinnae, the larger of these about 30 cm. long, 12 to 15 cm. broad, oblong-ovate, the tertiary rachis narrowly alate toward the tip, the segments 9 to 11 pairs, wide-spreading, 6 to 8 cm. long, 1.3 to 1.8 cm. broad, oblong-lanceolate, acuminate to long-acuminate, strongly inequilateral at the base (the distal side widely exciso-cuneate, the proximal side rounded or evenly cuneate), the margins elsewhere sharply and deeply dentate-serrate, subrevolute in drying; larger primary pinnae 4 pairs, opposite, the second pair similar to the basal but less basispic, 70 cm. long, 45 cm. broad, the third pair 60 cm. long, 35 cm. broad, the fourth pair 40 cm. long, 25 cm. broad, all these bipinnate like the basal pair but their segments gradually smaller (2 to 2.5 cm. long, 9 or 10 mm. broad in the fourth pair) and the tertiary rachises more strongly alate; fifth pair of primary pinnae simply pinnate, 30 cm. long, 10 cm. broad; sixth and seventh pairs successively smaller, the apex of the lamina (15 cm. long) abruptly pinnate; veins about 15 pairs, oblique, distant (arising 4 to 5 mm. apart), mostly once forked at or near the base, or the anterior branch occasionally forked again; synangia usually 12 to 20 pairs, 2 to 3 mm. from the margin, 1.5 to 3 mm. long, ovoid, laterally compressed above, deeply cleft, the two divisions wide-spreading at maturity, each containing 8 to 10 loculi. Rachises bearing a few slender deciduous flaccid brownish scales; leaf tissue rigidly herbaceous, dull green in drying, slightly lighter beneath.

Type in the U. S. National Herbarium, nos. 675926-936, consisting of an entire frond, collected in humid forest of Cuesta de Las Palmas, southern slope of Cerro de la Horqueta, Chiriqui, Panama, altitude 1,700 to 2,100 meters, March 18, 1911, by William R. Maxon (no. 5525).

In general form *M. chiricana* is apparently somewhat similar to *M. interposita*, but differs from that species widely in its much greater size, and in its very much larger, more distant, and more deeply inciso-serrate segments. The synangia also are much larger and are not submarginal, as in that species. It is apparently common in the dense, wet forests of the mountainous region of western Chiriqui above El Boquete. The following additional specimens were collected:

PANAMA: Near Los Sigüas Camp, southern slope of the Cerro de la Horqueta, Chiriqui, alt. 1,700 meters, *Maxon* 5424. Forest along the upper Caldera River, near "Camp I," Holcomb's trail, above El Boquete, Chiriqui, alt. 1,450 to 1,650 meters, *Maxon* 5620.

The description is drawn entirely from the type specimen and unusually complete measurements are purposely given, since owing to piecemeal collecting these are ordinarily not available for most species of this genus.

***Marattia pittieri* Maxon, sp. nov.**

Stipe stout, 60 cm. long; lamina broadly pentagonal-deltoid, 1.5 meters broad at the base, 1.2 meters long, quadripinnate as to the strongly basispic basal pinnae,

<sup>1</sup> Pages 21-23. 1909.



otherwise tripinnate nearly throughout; primary and secondary rachises stout, terete, marginate only at their extreme apices; basal primary pinnae deltoid, 75 cm. long, 60 cm. broad at the strongly equilateral base, the inferior basal secondary pinna 40 cm. long and 25 cm. broad (the proximal portion strongly produced), the superior basal secondary pinna 20 cm. long and 9 cm. broad, the other secondary pinnae more nearly equal, essentially so near the abruptly acuminate apex, the tertiary rachises alate only toward the apices; second pair of primary pinnae less basisropic, deltoid, 55 cm. long, 30 cm. broad; third and fourth pairs nearly equilateral, respectively, 30 and 40 cm. long, 23 and 17 cm. broad, the succeeding pinnae (about 3 pairs) successively shorter and finally simply pinnate below the abruptly short-acuminate apex of the lamina; larger pinnules (third order) of the basal part of the frond 10 to 17 cm. long, 2.5 to 7 cm. broad, oblong, acuminate, pinnate (the rachises widely alate), the quaternary segments mostly oval to oblong (1 to 1.5 cm. long), rounded or obtuse, lightly crenate, with 5 to 7 pairs of simple or once forked dark veins, or a few of the largest ones longer (3 to 4.5 cm. long), deeply lobed, with 7 to 10 pairs of veins, each of these with several alternate branches within the lobes. Under surfaces of the secondary and tertiary rachises bearing a few thin flaccid light brown scales; ultimate rachises and veins bearing a few whitish spine-like trichomes upon the upper surface; leaf tissue naked upon both surfaces, dark green, slightly lighter beneath.

Type in the U. S. National Herbarium, nos. 676198-203, consisting of a single frond, collected in humid forest near the upper Caldera River, at "Camp I," Holcomb's trail, above El Boquete, Chiriqui, Panama, altitude 1,625 meters, March 24, 1911, by William R. Maxon (no. 5704).

Only a single plant of this species was observed during three days' collecting in the general region of "Camp I" and this, unfortunately, had but one frond. The characters afforded by this individual, however, even in a sterile condition, are sufficiently marked to warrant its description as a new species. In the remarkable basisropic development of the basal pinnae, as well as in the widely alate tertiary rachises and the peculiar spine-like trichomes of the upper leaf surface, *Marattia pittieri* shows an undoubted affinity with *M. kaulfussii*, so that there can be scarcely any question as to its proper reference to the subgenus *Eupodium*. From *M. kaulfussii* it differs greatly in its enormous size and in its much larger and differently shaped segments, which for the most part are lightly crenate, only the very largest ones in the most dissected part of the basal pinnae being lobed.

Named in honor of Mr. Henry Pittier, with whom the writer was associated in botanical exploration during the Smithsonian Biological Survey of the Panama Canal Zone and adjacent territory.

### NOTES ON LYCOPODIUM.

The following notes are in continuation of earlier studies of tropical American species of *Lycopodium*, published either separately or as parts of longer papers, and relate mainly to species previously described. There are included, also, descriptions of two new species, and the publication of the new name *Lycopodium blepharodes*, applied to a South American plant described originally under an invalid name.

***Lycopodium dichotomum* Jacq. Enum. Stirp. Vind. 314. 1762.**

The original description of this species in 1762, though brief, is sufficiently complete to fix its application to the plant so elaborately figured by the same writer a few years later.<sup>1</sup> The type is from Martinique, and the species is not uncommon in the West Indies and continental North America, excellent specimens being at hand from

<sup>1</sup> Hort. Bot. Vind. 3: pl. 45. 1776.



Dominica, Grenada, Santo Domingo, Cuba, Jamaica, Mexico, Guatemala, and Costa Rica. Not infrequently plants produce sporangia while still very small (10 cm. long, or less) and only once or twice dichotomous. This state was described as a new species, *Lycopodium barbatum* Christ,<sup>1</sup> in 1905, upon a Costa Rican specimen collected by Wercklé, a portion of which Prince Roland Bonaparte has courteously presented to the U. S. National Museum. Matching it completely are certain specimens from Costa Rica (*Ridgway*), Nicaragua (*Flint; Wright*), and Brazil (*Lindman* A2705); while a second Brazilian specimen (*Malme* 1664) shows a less juvenile condition approaching the normal form of the species. This species is unusually variable in the direction of its leaves, the less mature plants not being typical in this respect.

***Lycopodium wilsonii*** Underw. & Lloyd, Bull. Torrey Club 33: 109. 1906.

In the original description of *L. wilsonii* only the type specimens (*Wilson* 153) were mentioned. There are in the U. S. National Herbarium two additional collections of this species, both from the type region, the Sierra Luquillo.

PORTO RICO: Sierra de Luquillo, in sylvis montis Yunque, July 13, 1885, *Sintenis* 1543 (distributed as *L. dichotomum*). El Yunque, March, 1912, *Hioram* 383.

***Lycopodium blepharodes*** Maxon, nom. nov.

*Lycopodium affine* Hook. & Grev. Bot. Misc. Hook. 2: 364. 1831, not Bory, 1804.

TYPE LOCALITY: Mount Pichincha, Ecuador (*Jameson*).

DISTRIBUTION: Mountains of Ecuador and Venezuela, ascending to 3,300 meters.

This species, of which several collections from Ecuador and Venezuela are mentioned by Hooker and Greville and by Spring, can not retain the name *affine* on account of the earlier use of this name by Bory for a very unlike species (from Bourbon) which is an ally of *L. carolinianum*. The South American plant is accordingly here renamed *blepharodes*, in allusion to the numerous curved cilia which fringe both sporophylls and leaves. Two sheets of Ecuador specimens, both collected by Jameson, one of them labeled Cerro de Pichincha, are in the National Herbarium, and a third, also from the Quitensian Andes, collected by Jameson, is in the Gray Herbarium. These agree well with the descriptions by Hooker and Greville and Spring.<sup>2</sup> The habit of the specimens points unmistakably to an epiphytic habitat.

The Costa Rican specimens erroneously referred to this species by Hieronymus are to be regarded as a new species, *L. hoffmanni*.

***Lycopodium hoffmanni*** Maxon, sp. nov.

Plants apparently terrestrial, rigidly arcuate-ascending or erect, 25 to 40 cm. long, once or twice (rarely 3 times) dichotomous, the divisions erect, diverging at a very acute angle, continuously or discontinuously sporangiate in the apical half or two-thirds. Stems 2 to 3 mm. in diameter, woody; leaves and sporophylls alike, borne apparently in 10 ranks, ascending or mostly spreading and recurved, wholly or partially concealing the stem, radial, straight or nearly so, not twisted at the base, lanceolate to narrowly deltoid-lanceolate, 5 to 7 mm. long, 1 to 1.5 mm. broad at or just above the base, gradually narrower toward the acute (but not attenuate) apex, thick, rigidly spongiose-herbaceous, dull yellowish green, the inner surface slightly concave and sometimes transversely corrugate, the outer surface often longitudinally striate in drying, the costa percurrent, evident as a slight dorsal ridge, a little stronger at the base and decurrent, the stem thus angled, but not sharply so; margins of the leaves and sporophylls strongly hyaline, distantly denticulate-serrulate, the teeth mostly low and rounded or those of the sporophylls a little more evident, sharper and closer; sporangia crowded, orbicular-reniform, 1.5 to 2 mm. broad, extending far beyond the sides of the sporophylls.

<sup>1</sup> Bull. Herb. Boiss. II. 5: 254. 1905.

<sup>2</sup> Mém. Acad. Sci. Brux. 15<sup>o</sup>: 21. 1842; *ibid.* 24<sup>1</sup>: 6. 1850.



Type in the U. S. National Herbarium, no. 691549, collected upon the Volcán de Barba, Costa Rica, August 28, 1855, by Dr. C. Hoffmann (no. 85).

Hieronymus<sup>1</sup> has listed this number under *Lycopodium affine* Hook. & Grev., here renamed *L. blepharodes* Maxon, remarking that it differs slightly in its shorter-denticulate leaves. The differences, however, are pronounced and clearly entitle this Costa Rican plant to recognition as a distinct species. It departs widely from *L. blepharodes* in habit, in having the leaves and sporophylls smaller, less deltoid, less concave, and not at all strongly carinate, and particularly in the character of the margins. The leaves and sporophylls of *L. blepharodes* are conspicuously long-ciliate throughout, while no cilia whatever occur in *L. hoffmanni*. The difference in habit is equally pronounced, *L. blepharodes* being unmistakably a pendent epiphyte and *L. hoffmanni* a plant of erect growth, presumably terrestrial. The general habit of *L. hoffmanni* is exactly that of the common tropical American *L. reflexum* Lam., a species which otherwise it does not closely resemble. That species occurs invariably upon the ground, either in half-shaded thickets or upon open banks or even on cliffs; while *L. hoffmanni* has the appearance of a plant growing among litter of the forest floor, like *L. montanum* Underw. & Lloyd, of Jamaica, and *L. hippurideum* Christ, of Costa Rica and western Panama.

A single additional specimen of *L. hoffmanni* has been seen:

COSTA RICA: Forest of Volcán de Barba, alt. 2,500 meters, February 6, 1890.  
Tonduz 1990 (determined by Christ as *L. attenuatum* Spring).

***Lycopodium regnellii* Maxon, sp. nov.**

PLATE 23.

Plant probably terrestrial, stout, rigidly erect from a decumbent base, 4 or 5 times dichotomous, the numerous apical branches closely fasciculate and almost continuously sporangiate. Stem woody, about 4 mm. in diameter at the base; leaves in the basal half of the plant mostly divaricate or even reflexed in drying, arranged in 10 to 12 ranks, crowded and nearly concealing the stem, radial, straight or nearly so, lance-subulate, 7 to 10 mm. long, 1.3 to 1.6 mm. broad at the base, thence gradually and evenly long-acuminate, pungent, rigidly coriaceous-herbaceous but relatively thin, flattish, strongly costate throughout (the leaf narrowly carinate ventrally, more obtusely so upon the upper surface), the margins hyaline, subentire or very minutely sinuate; ultimate branches fertile, 4 to 5 mm. in diameter (including sporophylls), the sporophylls similar to the leaves of the lower branches but smaller (3 to 5 mm. long) and more abruptly and sharply long-acuminate; sporangia orbicular-reniform, 1 to 1.4 mm. broad.

Type in the U. S. National Herbarium, no. 201172, collected in the vicinity of Caldas, province of Minas Geraës, Brazil, October 21, 1868, by A. F. Regnell (III.1500).

*Lycopodium regnellii* is a member of the *selago* subgroup and is apparently well distinguished from related South America species by the contrasting direction of the leaves and sporophylls, the former being strongly divaricate from the stems, the latter imbricate and closely appressed. Only the type specimen has been seen.

EXPLANATION OF PLATE 23.—From a photograph of the type specimen. Slightly more than one-half natural size.

***Lycopodium hippurideum* Christ in Pittier, Prim. Fl. Costar. 3<sup>1</sup>: 56. 1901.**

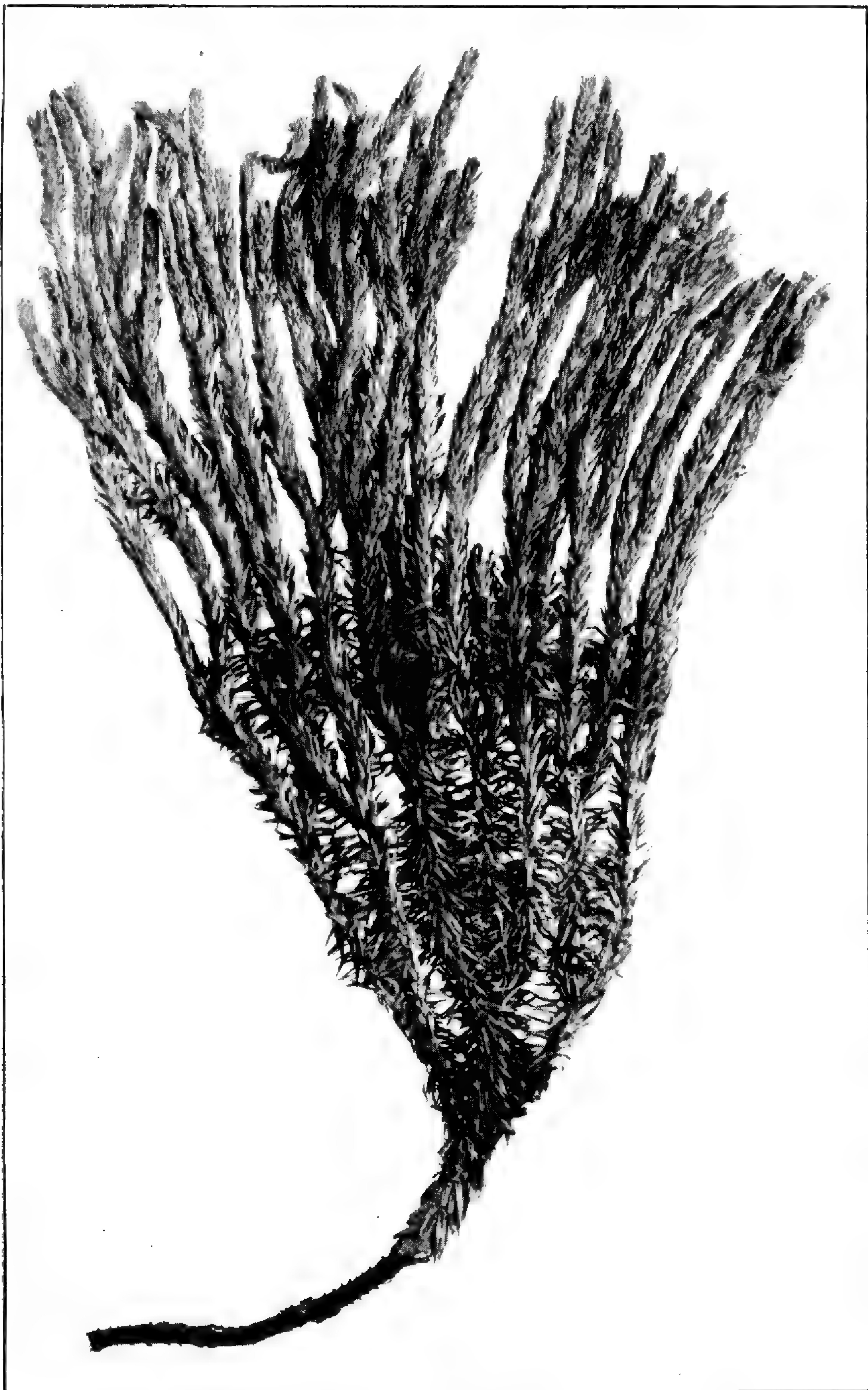
This species, known previously only from the high mountains of Costa Rica (*Pittier* 10619; *Tonduz* 1989) was collected in quantity by the writer, in 1911, at the edge of moist woods above El Potrero Camp, Chiriqui Volcano, Panama, altitude 2,900 meters (*Maxon* 5375).

***Lycopodium pithyoides* Schlecht. & Cham. Linnaea 5: 623. 1830.**

Since the publication of Underwood and Lloyd's article upon the tropical American species of *Lycopodium*<sup>2</sup> this species has been collected at Jalapa, Mexico, the type

<sup>1</sup> Bot. Jahrb. Engler 34: 571. 1905.    <sup>2</sup> Bull. Torrey Club 33: 101-124. 1906.





LYCOPodium regnellii MAXON.



locality, by Messrs. Barnes, Chamberlain, and Land, and reported on by them.<sup>1</sup> A part of this material has been presented to the U. S. National Museum. An additional collection also may be cited:

GUATEMALA: Near Coban, Alta Verapaz, alt. 1,300 meters, on tree trunks, August, 1885, *von Türckheim* (J. D. Smith, no. 551); distributed as *L. dichotomum* Jacq., "form (*L. mandioccanum*, Raddi)."

***Lycopodium watsonianum*** Maxon, *Smiths. Misc. Coll.* 56<sup>29</sup>: 3. pl. 3. 1912.

*Lycopodium watsonianum*, described from a single specimen collected by the writer in humid forest along the upper Caldera River, Chiriqui, Panama (*Maxon* 5712), may now be reported from Costa Rica, upon the basis of a specimen collected near the Rancho Flores, altitude 2,043 meters, by A. Tonduz (no. 2081).

***Lycopodium cuneifolium*** Hieron. *Bot. Jahrb. Engler* 34: 572. 1905.

Besides the original Costa Rican specimens (*Hoffmann* 59) and the Colombian plant (*Moritz* 371) cited by Hieronymus the following may be mentioned:

COSTA RICA: Laguna de Reventado, Volcano Irazú, alt. 2,800 meters, *Pittier* 14136. Forests of Achiote, Volcano Poas, alt. 2,200 meters, *Tonduz* 10740.

PANAMA: Below summit of Cerro de la Horqueta, Chiriqui, alt. about 2,150 meters, *Maxon* 5475.

***Lycopodium subulatum*** Desv. in *Lam. Encycl. Bot. Suppl.* 3: 544. 1813.

*Lycopodium biforme* Hook. *Icon. Pl.* 3: 228. 1840.

This species, which is undoubtedly a variable one, is not reported from North America by Underwood and Lloyd. Identifying it on the basis of Hooker's plate, the following specimens in the National Herbarium may be cited:

COSTA RICA: Forests of Volcan de Barba, alt. 2,500 to 2,700 meters, *Tonduz* 1958.

PANAMA: Humid forest near Cerro de la Horqueta, Chiriqui, alt. 2,200 meters, *Maxon* 5482.

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<sup>1</sup> *Bot. Gaz.* 44: 57-63. pl. 5, 6. 1907.



# STUDIES OF TROPICAL AMERICAN PHANEROGAMS— NO. 1.

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By PAUL C. STANDLEY.

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## INTRODUCTION.

The present paper introduces a series which is intended to include notes upon plants of tropical and subtropical North and South America and descriptions of miscellaneous new species, as also taxonomic reviews of some of the smaller genera. The plants discussed in the first installment are some which were studied by the writer while preparing a report upon certain families for a proposed flora of Panama. They belong to the Cyperaceae, Gentianaceae, Rubiaceae, and the families formerly associated as the Leguminosae. The determination of the Panaman species of *Sommeria*, *Watsonia*, and *Cobaea* has necessitated a revision of these genera, the results of which are here published. Most of the new species are from the large collections made by Mr. H. Pittier in Colombia and in Central America, especially in Costa Rica.

Unless otherwise indicated, all specimens cited are in the United States National Herbarium.

## TWO NEW SPECIES OF DICHROMENA.

*Dichromena* is one of the smaller genera of the Cyperaceae, but several of its species have a wide distribution in tropical America. The two species described here are apparently of limited distribution.

*Dichromena pittieri* Standley, sp. nov.

Perennial from a cluster of fibrous roots; leaves very numerous, flat, 8 to 15 cm. long, 2 to 4 mm. wide, attenuate, not dilated at the base, pale grayish green, densely velvety-pubescent on both surfaces with short, very fine hairs; culms numerous, obtusely angled, slender, slightly surpassing the leaves, 16 to 21 cm. high, densely pubescent; bracts of the inflorescence about 6, 2 to 10 cm. long, often with a few very short additional ones, about as wide as the leaves, slightly discolored at the base and ciliate, elsewhere finely and densely pubescent; spikelets numerous, 8 to 12, 4.5 to 5 mm. long, densely capitate, the whole head about 1 cm. in diameter; scales white, glabrous, oblong, ovate, or lanceolate, acute, thick and firm, prominently keeled but without other evident nerves; style linear, the branches much elongated; achene about 1 mm. long, broadly obovoid, brownish white, shining, very finely and rather obscurely transversely undulate; beak broadly pyramidal, about one-fourth as long as the achene.



Type in the U. S. National Herbarium, no. 691286, collected between Quebrada del Bollo and El Platanal, on the trail from Río Frío to San Andrés de la Sierra, State of Magdalena, Colombia, altitude about 1,000 meters, July, 1906, by H. Pittier (no. 1692).

A very distinct species, related to *D. ciliata*, but distinguished by its abundant pubescence, pale leaves, densely capitate inflorescence of numerous small spikelets, and pale achenes.

***Dichromena ebracteata* Standley, sp. nov.**

Perennial from a slender dark brown creeping rhizome; leaves numerous, thin, flat, bright green on the upper surface or sometimes glaucous, glaucous beneath, 8 to 16 cm. long, about 2.5 to 5 mm. wide, dilated at the base and ciliate, elsewhere finely pubescent with spreading or somewhat appressed hairs or glabrate; culms very slender, 6 to 20 cm. high, usually shorter than the longer leaves but sometimes longer, finely villous or glabrous; bracts represented by 1 or 2 subulate-lanceolate green membraceous-margined scales 2 mm. long or less; spikelets 3 to 8, subspicate, sessile or one of them short-pedunculate, 5 to 10 mm. long; scales of the spikelets nearly white, thin, glabrous, oblong, obtuse, often emarginate, keeled; style linear, with elongated branches; achenes broadly obovoid, 1 mm. long, yellowish green, finely rugulose with faint transverse undulate lines, the beak one-third as long, white, thin.

Type in the U. S. National Herbarium, no. 692624, collected in Lot 42, Island of Tobago, along banks, April 21, 1913, by W. E. Broadway (no. 4455).

ADDITIONAL SPECIMENS EXAMINED:

TOBAGO: Forest Reserve, above Caledonia, *Broadway* 3071.

VENEZUELA: El Valle, Island of Margarita, *Miller & Johnston* 190.

*Dichromena ebracteata* is as closely related to *D. ciliata* Vahl as to any species, but from this and all others heretofore described it may be distinguished by the abortive involucre bracts, these being much shorter than the spikelets. The Venezuelan specimen was distributed as *Dichromena leucocephala* Michx. (*D. colorata* (L.) Hitchc.), a species with which it has little in common.

### THE GENUS BISBOECKELERA.

In 1842 Nees von Esenbeck described in Martius's *Flora Brasiliensis*<sup>1</sup> a new genus of Cyperaceae, which he called *Hoppia* in honor of the German botanist Hoppe. Unfortunately, there was already a genus *Hoppea* of the Gentianaceae, dedicated by Willdenow in 1801<sup>2</sup> to a man of the same name. This was used in the form *Hoppea* by Sprengel in 1818.<sup>3</sup> Taking the proper view that Nees's name should be replaced, Otto Kuntze in 1891<sup>4</sup> suggested *Bisboeckelera* as a substitute, and this name, although ill-formed, is the one that must be used.

The genus consists of but few species, all from the western and northern parts of tropical South America. It was considered by Nees a member of the tribe Cariceae, while Bentham and Hooker<sup>5</sup> placed it in the Cryptangieae. Pax, in his treatment of the family in Engler and Prantl's *Natürlichen Pflanzenfamilien*,<sup>6</sup> associated

<sup>1</sup> 2<sup>1</sup>: 199. pl. 30.

<sup>2</sup> Ges. Naturf. Freund. Berlin Mag. 3: 434.

<sup>3</sup> Anleit. Gewächse. 2<sup>2</sup>: 889.

<sup>4</sup> Rev. Gen. Pl. 2: 747.

<sup>5</sup> Gen. Pl. 3: 1042. 1883.

<sup>6</sup> 2<sup>2</sup>: 119. 1887.





BISBOECKELERA VINACEA STANDLEY.



this and five other related genera of South American plants as a new tribe, the Hoppieae. On account of the lapse of the generic name *Hoppea* in the Cyperaceae, this was replaced by the same author with the tribal name *Bisboeckelerieae*<sup>1</sup>

The species, so far as known, are enumerated below. Two of them, *B. bicolor* and *B. vinacea*, are closely related to the type of the genus (*Hoppia irrigua* Nees), but the others diverge considerably in general appearance and may not be congeneric.

***Bisboeckelera angustifolia*** (Boeckel.) Kuntze, Rev. Gen. Pl. 2:747. 1891.

*Hoppia angustifolia* Boeckel. Flora 54:37. 1871.

TYPE LOCALITY: French Guiana.

***Bisboeckelera berroi*** (Clarke) Standley.

*Hoppia berroi* Clarke, Kew Bull. Misc. Inf. add. ser. 8:62. 1908.

The type is from Paso de los Toros, Uruguay, collected by Berro (no. 2169).

***Bisboeckelera bicolor*** (Clarke) Standley.

*Hoppia bicolor* Clarke, Kew Bull. Misc. Inf. add. ser. 8:62. 1908.

Collected by Riedel in Brazil, Minas Geraes, Una, near Ouro Preto. It is described as having the upper surface of the leaves of a copper-brown color and the lower surface glaucous.

***Bisboeckelera irrigua*** (Nees) Kuntze, Rev. Gen. Pl. 2:747. 1891.

*Hoppia irrigua* Nees in Mart. Fl. Bras. 2<sup>1</sup>:199. pl. 30. 1842.

The type was collected "In lapidosis udis silvarum ad flumen Japurá prope Manacarú et ad portum prov. fluminis Nigri."

***Bisboeckelera longifolia*** (Rudge) Standley.

*Schoenus longifolius* Rudge, Pl. Guian. 14. pl. 16. 1805.

*Hoppia microcephala* Boeckel. Flora 54:37. 1871.

*Bisboeckelera microcephala* Kuntze, Rev. Gen. Pl. 2:747. 1891.

The type of this species was collected somewhere in the Guianas by an unknown collector. The type of *Hoppia microcephala* is from Surinam.

***Bisboeckelera vinacea*** Standley, sp. nov.

PLATE 24.

Perennial with many coarse purplish fibrous roots and numerous horizontal rhizomes covered with overlapping purplish leaflike bracts; leaves all radical, 38 cm. long or less, the outermost shortest, about 2 cm. wide, acute, glaucous on the upper surface and glabrous or with a few scattered hairs, scabrous and glandular on the midvein, beneath of a deep purplish red, strongly nerved, glandular-puberulent, narrowed below but expanded into a broad and sheathing base, scaberulous on the margins, these inrolled in drying; culm naked, about 25 cm. long, triangular, brown, scaberulous on the angles; bracts of the inflorescence 2, similar to the leaves, the longer 50 mm. long, the other about 15 mm.; inflorescence of about 7 dense oblong sessile spikes 15 to 20 mm. long; glumes at the base of each spikelet 2, oblong-lanceolate, acute, purplish, puberulent; spikelets consisting each of 1 fertile and 2 sterile florets; mature perigynium 5 to 6 mm. long, ovoid, tapering into a long subulate beak, purplish red, faintly nerved, puberulent; achene 2 mm. long and of the same diameter, obtusely angled, dark brown, shining, smooth, contracted at the base into a short stipe, bearing on the apex a short beak about one-fourth the length of the body.

<sup>1</sup> In Engl. & Prantl, Pflanzenfam. Nachtr. 47. 1897.



Type in the U. S. National Herbarium, no. 530770, collected near Córdoba, in the Dagua Valley, Pacific Coastal Zone, State of Cauca, Colombia, altitude 30 to 100 meters, December, 1905, by H. Pittier (no. 583).

Closely related to the type of the genus, *B. irrigua*, but differing in the form of the fruit, which is not ridged on the angles and depressed on the sides, in the short involucre bracts, and in the more ample, differently arranged inflorescence. Nees does not speak of a purplish coloration of the lower surface of the leaves of his plant, although he does state that the petioles are reddish. Probably the coloration of the leaf surfaces is distinctive in this Colombian species.

EXPLANATION OF PLATE 24.—Type specimen. Two-fifths natural size.

### NEW LEGUMINOUS PLANTS OF SEVERAL GENERA.

The two species of *Phaseolus* of the section *Leptospron* described below have been confused with *P. speciosus* H. B. K. That plant was described from specimens collected along the Orinoco River, and it is doubtful whether it occurs in Central America. It differs from both the Guatemalan species in having the lower calyx lobes only slightly longer than the upper, as well as in other minor characters.

The remaining species are of the genera *Chamaecrista*, *Calliandra*, *Mimosa*, *Erythrina*, and *Dolicholus*. All are from Guatemala and Costa Rica, except a new species of *Dolicholus* collected by Mr. Pittier in Colombia.

*Phaseolus spectabilis* Standley, sp. nov.

PLATE 25.

Stems twining, slender, densely pilose with rather short hairs; stipules oblong-ovate, 3 to 4 mm. long, persistent, obtuse or acute, finely parallel-nerved, pilose, not produced at the base; petioles 2 to 9 cm. long, pilose; stipellæ oblong to rounded-ovate, obtuse, 2 mm. long; petiolules 3 mm. long or less; leaflets ovate to oblong or rhombic-lanceolate, 5 to 11 cm. long, 2 to 6 cm. wide, the lateral ones asymmetrical, the terminal one larger than the others, all rounded at the base, acute or abruptly short-acuminate, thick and firm, lustrous on the upper surface and scaberulous, beneath sericeous but not densely so, prominently veined; racemes 8 to 17 cm. long, nodose, pilose; bracts deciduous, ovate, acute to abruptly acuminate, 5 to 7 mm. long; pedicels 4 mm. long or less; calyx 15 to 20 mm. long, pilose, the tube broadly campanulate, 5 mm. long, the upper lip very broad, shallowly emarginate, the lower lip 3-lobed, the lobes twice as long as the tube or more, lanceolate or ovate, overlapping at the base, 6 mm. wide or less, attenuate to the apex; banner 3 cm. long, broadly obcordate, sessile, glabrous; wing petals and keel of about the same length, the latter several times spirally coiled; style strongly bearded; legumes about 14 cm. long and 8 mm. broad, straight, the valves glabrous, with thickened carinate margins.

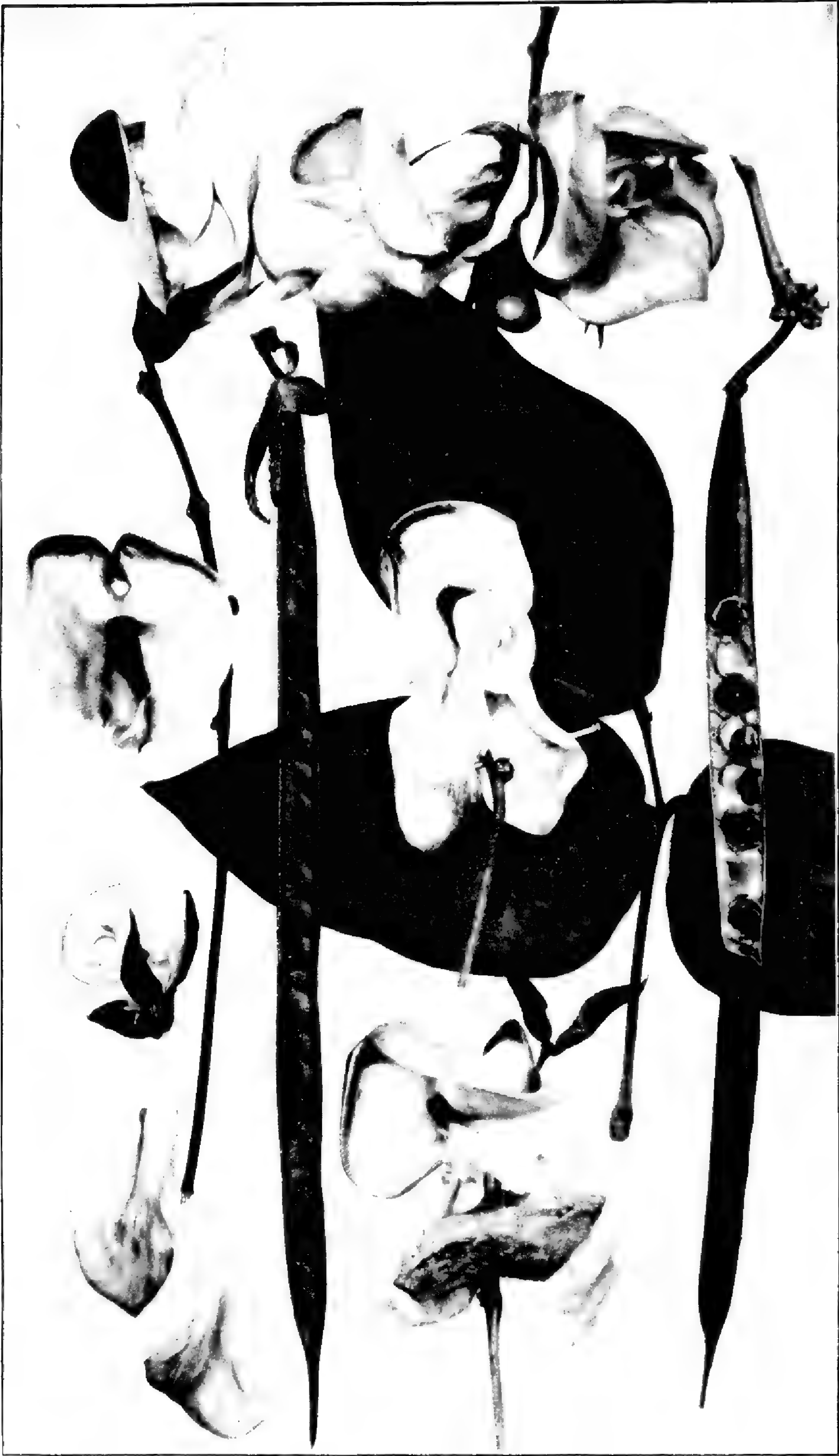
Type in the U. S. National Herbarium, no. 472942, collected in the vicinity of Secanquím, Department of Alta Verapaz, Guatemala, altitude 550 meters, May 7, 1905, by H. Pittier (no. 281).

#### ADDITIONAL SPECIMENS EXAMINED

GUATEMALA: Near the Finca Sepaculté, Alta Verapaz, Cook 15. Vicinity of Secanquím, Alta Verapaz, alt. 550 meters, Maxon & Hay 3145, 3146. Cubilquitz, Alta Verapaz, alt. 350 meters, von Türckheim (J. D. Smith, no. 7856).

EXPLANATION OF PLATE 25.—Leaf, fruit, and flowers of *Phaseolus spectabilis*, from the Finca Sepaculté, Alta Verapaz, Guatemala. Photographed by O. F. Cook. Natural size.





PHASEOLUS SPECTABILIS STANDLEY.



**Phaseolus stenolobus** Standley, sp. nov.

Stems slender, twining, pilose with reddish brown hairs; stipules persistent, not produced at the base, lanceolate, acute, 3 to 4 mm. long, conspicuously parallel-nerved, pilose; petioles slender, 4 to 8 cm. long, pilose; stipellæ minute; petiolules 3 mm. long or less; leaflets thin, rhombic-ovate to triangular-oblong, 6 to 11 cm. long, 3.5 to 7 cm. wide, acuminate, rounded or obtuse at the base, abundantly pubescent on the upper surface with long, very slender, appressed hairs having bulbous bases, softly pubescent beneath with similar hairs; peduncles 16 to 22 cm. long, pilose, the racemes short, few-flowered, nodose; bracts lance-linear or lanceolate, 9 to 12 mm. long, deciduous; pedicels 4 mm. long or less; calyx about 12 mm. long, sparsely pilose, the tube broadly campanulate, 3 mm. long, the upper lobe very short, shallowly emarginate, the 3 lower lobes linear, acute, 2 or 3 times as long as the tube; corolla segments about 3 cm. long, glabrous, subequal, the keel several times spirally coiled; style abundantly bearded above; fruit not seen.

Type in the U. S. National Herbarium, no. 355066, collected at Cerro Redondo, Department of Santa Rosa, Guatemala, altitude 1,500 meters, October, 1893, by Heyde and Lux (J. D. Smith, no. 6135).

Differing from the preceding species in the narrow calyx lobes, narrow bracts, and the different pubescence of the leaflets.

**Chamaecrista macropoda** Standley, sp. nov.

Stems probably prostrate, stout, abundantly setose and cinereous, copiously leafy; stipules lanceolate or ovate-lanceolate, about 12 mm. long, rather abruptly attenuate, aristate-tipped, obliquely rounded at the base, appressed to the stems, strongly nerved, setose on the margins; leaf rachis 2 to 3 cm. long, subulate-appendaged above the uppermost pair of leaflets, the lowest pair of leaflets borne near the base; petiolar gland very small, short-stipitate; leaflets 3 to 5 pairs, rather firm, narrowly oblong, 10 to 20 mm. long, 3.5 to 5 mm. wide, obtuse, aristate-tipped, obliquely rounded at the base, glabrous or sparingly ciliate, conspicuously pinnate-veined, the midvein excentric; flowers solitary or 2 in each axil; pedicels 20 to 37 mm. long, ascending, slender, glabrous, bearing a pair of small linear-subulate bracts near the apex; sepals 6 to 7 mm. long, thin, oblong-lanceolate, acute, subulate-tipped, glabrous or sparingly setose; petals about 8 mm. long; legumes 35 to 45 mm. long, 4.5 mm. wide, abruptly acutish, the beak about 1 mm. long, minutely appressed-pubescent, 10 to 12-seeded.

Type in the U. S. National Herbarium, no. 258959, collected on the Cerro Redondo, Department of Santa Rosa, Guatemala, altitude about 1,400 meters, in September, 1893, by Heyde and Lux (J. D. Smith, no. 6133).

Originally distributed as *Cassia grammica* Spreng., a South American species, the determination by Micheli. That species, however, has pubescent leaflets and larger flowers, and the leaflets are smaller and of different form. The Guatemalan plant is related to *Chamaecrista pilosa* and *C. serpens*; from the former it differs in having petiolar glands and from the latter in its larger, glabrous leaflets, much larger, broader stipules, and elongated, many-seeded legume.

**Calliandra mollis** Standley, sp. nov.

Stems herbaceous, erect or ascending, stout, branched, abundantly villous with tawny hairs; stipules triangular-ovate or triangular-lanceolate, acute, 5 to 7 mm. long, striate, pilose; rachis of the leaves 50 to 65 mm. long, villous with tawny hairs; pinnæ 4 to 6 pairs, 25 to 55 mm. long; leaflets 7 to 22 pairs, approximate, narrowly oblong, 8 to 18 mm. long, 2.5 mm. wide, obtuse, apiculate, oblique at the base, densely pilose with white hairs on both surfaces; inflorescence of terminal or axillary racemes, each of several or numerous heads; peduncles slender, 15 to 32 mm. long, densely villous with tawny hairs; bracts



conspicuous, triangular-lanceolate, acute, striate, ciliate, pilose; calyx subsessile, 2 mm. long, glabrous, cleft nearly to the base into triangular-oblong acutish lobes; corolla glabrous, about 4 mm. long, the lobes oblong, acute; stamens 15 to 20 mm. long; legumes about 8 cm. long, 6 or 7 mm. wide, rounded-obtuse, short-beaked, attenuate at the base, densely pilose with tawny hairs, about 8-seeded.

Type in the U. S. National Herbarium, no. 578114, collected in thickets near Nicoya, Costa Rica, in January, 1900, by A. Tonduz (Inst. Fís. Geogr. Costa Rica, no. 13536). Additional material is mounted on sheet 577750.

Closely related to *Calliandra portoricensis* and *C. tetragona*, but easily distinguished from both by the copious pubescence. In both of those species the fruit is glabrous. The leaflets are similar in form to those of *C. tetragona*, being broader than those of *C. portoricensis*.

**Mimosa maxonii** Standley, sp. nov.

A vine with slender terete green glabrous branches armed with numerous slender recurved spines 2 mm. long; stipules triangular-lanceolate, 3 to 4 mm. long, prominently nerved, pectinate-ciliate; petioles 30 to 55 mm. long, slender, glabrous, bearing very numerous slender recurved spines; pinnae 2 pairs, their rachises about 1 cm. long, slightly puberulent, yellow-setose at the point of insertion of the leaflets; leaflets 2 pairs, unequal, the inner leaflet of the lower pair much reduced, all elliptic-lanceolate or oblong-lanceolate, 38 mm. long or less, 4 to 11 mm. wide, acute or acuminate, rounded or obtuse and very unequal at the base, with a strongly excentric midvein, glabrous on the upper surface, beneath glabrous or with a few scattered setose-strigose yellowish hairs, the margin appearing nerved from the presence of a series of overlapping spiny-strigose hairs; peduncles 10 to 27 mm. long, divergent or ascending, stout, sparingly spiny; bracts of the spherical inflorescence (5 to 6 mm. in diameter) linear-lanceolate, about equaling the flowers, each with a rigid subulate tip; corolla glabrous, smooth, 2 mm. long; stamens 5; fruit oblong or narrowly oblong, 18 to 25 mm. long, 6 to 8 mm. wide, obtuse or abruptly acute, bearing a beak 1 mm. long, subsessile, 2 to 4-seeded, spiny-setose on the margins, the spreading setae 3 to 5 mm. long, the valves finely and very densely velvety-pubescent, articulate.

Type in the U. S. National Herbarium, no. 473478, collected in the vicinity of Mazatenango, Guatemala, altitude about 350 meters, February 20, 1905, by William R. Maxon and Robert Hay (no. 3497).

Related to *Mimosa velloziana* Mart., but readily distinguished by the velvety-pubescent valves of the fruit.

**Erythrina lanceolata** Standley, sp. nov.

A small, densely branched tree; branches slender, grayish, closely armed with stout, dark brown spines about 4 mm. long; petioles slender, striate, 45 to 60 mm. long, swollen at the base, armed with numerous short stout spines, glabrous; petiolules stout, 5 or 6 mm. long; leaflets rather thick and firm, dull green, lanceolate or rhombic-lanceolate, 7 to 11 cm. long, 28 to 44 mm. broad, rather abruptly acuminate, cuneate or broadly cuneate at the base, glabrous, 3-nerved, with a few lateral nerves from the midvein, the veins conspicuous and more or less reticulate, the lateral leaflets slightly smaller than the terminal one and inequilateral; racemes 5 to 17 cm. long, rather slender, few-flowered, the rachises at first tomentulose but soon glabrate; pedicels 5 mm. long or shorter; calyx tubular-campanulate, 8 mm. long or less, obtuse at the base, shallowly 2-lipped, the upper lip retuse, obscurely tomentulose, soon glabrate; banner green and red, about 6 cm. long, 9 mm. wide, linear-oblong, straight, glabrous; keel petals distinct, 45 mm. long,



abruptly acute at the base, with a short acute triangular beak at the apex, undulate-margined; wings oblong, obtuse, about equaling the keel; stamens 10, 9 of the filaments adnate for nearly half their length, the tenth free nearly to the base; ovary tomentulose.

Type in the U. S. National Herbarium, no. 678761, collected at San Cristóbal de Candelaria, province of Cartago, Costa Rica, altitude 1,700 meters, by C. Wercklé (H. Pittier, no. 3693).

Similar to *Erythrina americana* Mill. in the form of the flowers, but differing in the short calyx, slender branches, and narrow leaflets. The leaflets are much narrower than those of any other American species.

***Dolicholus pittieri* Standley, sp. nov.**

Stems twining, stout, woody, the younger ones terete, densely viscid-tomentose with short yellow hairs; stipules lanceolate, acute, 4 to 5 mm. long, densely tomentose, soon deciduous; petioles 2 to 3 cm. long, densely viscid-tomentose; stipellæ 2 mm. long, subulate; petiolules about 2 mm. long; leaflets oblong or oblong-lanceolate to ovate, 40 to 65 mm. long, 22 to 33 mm. wide, abruptly acute, rounded to subcordate at the base, dull green, thick and subcoriaceous, glandular on the upper surface and softly pubescent with fine short hairs, conspicuously reticulate-veined beneath and abundantly tomentose with short tawny hairs; racemes axillary, stout, 12 to 17 cm. long, the rachises densely viscid-tomentose, the few flowers rather distant; bracts deciduous, lanceolate, shorter than the buds; calyx about 2 mm. long, about equaling the corolla, the lobes linear or linear-lanceolate, attenuate, the lowest much longer than the others, all several times longer than the short campanulate tube, the whole calyx densely glandular-pubescent; corolla pale yellow, the banner obovate, emarginate, glabrous, the keel and wings of about the same length; legume 3 to 4 cm. long, 1 cm. broad, straight along the upper suture, curved below, broadest toward the apex, acute, short-beaked, glandular and viscid-hirsute with tawny hairs; seeds 2, mature ones not seen.

Type in the U. S. National Herbarium, no. 530856, collected around Cali, western side of Cauca Valley, State of Cauca, Colombia, altitude 1,000 to 1,200 meters, December, 1905, by H. Pittier (no. 668).

In general appearance this is similar to *Dolicholus discolor* (Mart. & Gal.) Rose, a plant of Guatemala and southern Mexico. It differs in its viscid pubescence, narrower and longer calyx lobes, and glabrous banner.

**TWO NEW SPECIES OF LEIPHAIMOS.**

*Leiphaimos*, better known by the name *Voyria*, is a remarkable genus of the Gentianaceae which might well be taken as the type of a distinct family, as has been suggested. The plants differ from other Gentianaceae in being colorless parasites whose leaves are reduced to scales. A large number of species are known from the humid forests of northern South America and a few from tropical North America.

***Leiphaimos costaricensis* Standley, sp. nov.**

Stems slender, succulent, terete, glabrous, erect, simple, 7 to 13 cm. high, one-flowered; cauline scales 4 or 5 pairs, distant, 5 to 6 mm. long, connate for about one-third their length, narrowly oblong, acute, subulate-tipped, glabrous; calyx subtended at the base by a pair of connate scales similar to the cauline ones, or the flowers sometimes short-pedunculate; calyx 7 mm. long, cleft one-



third the distance to the base, the tube cylindric-campanulate, the lobes oblong-linear to narrowly triangular, acuminate; corolla yellow, the tube slenderly cylindric, dilated in the throat for about 6 mm., 35 to 45 mm. long, about 1 mm. in diameter, puberulent within; corolla lobes elliptic to narrowly elliptic-lanceolate, 10 to 12 mm. long, 2 mm. wide or less, acuminate, conspicuously veined, spreading or somewhat reflexed, puberulent at the base on the inner surface; corolla tube bearing at the base outside a cuplike appendage adherent to the tube, this 1.25 mm. high, with obtusely 5-toothed margin; anthers sessile, broadly oblong, united by their edges, 1.25 mm. long, not appendaged; style stout, 20 to 22 mm. long, puberulent, flattened and very narrowly winged; stigma capitate, 1.5 mm. in diameter and about as high, convolute and tuberculate on the upper surface; capsules sessile, 11 mm. long, 2 mm. in diameter. linear-oblong in outline, acutish at the base, tapering gradually to the base of the style.

Type in the U. S. National Herbarium, no. 365960, collected in the Helechaes del General, Diquís Valley, Costa Rica, altitude 700 meters, February 2, 1898, by H. Pittier (Inst. Fís. Geogr. Costa Rica, no. 12010).

Related to *Leiphaimos aphylla* (Jacq.) Gilg, one of the most widely dispersed members of the genus. That species has much broader and shorter corolla lobes and free anthers.

***Leiphaimos oreophila* Standley, sp. nov.**

Stems slender, terete, glabrous, erect, simple, 6 to 8 cm. high, commonly twisted, one-flowered; cauline scales usually 5 pairs, 5 mm. long, connate for half their length, the free portion lance-oblong or narrowly triangular, acuminate, glabrous; peduncles stout, 3 to 11 mm. long; calyx tubular, somewhat inflated by the maturing capsule, 6 mm. long, 1.5 mm. in diameter, the teeth one-half as long as the tube or less, triangular, acute or acutish, a discoid gland borne inside the calyx near the base, one below each lobe; corolla apparently yellow, the tube cylindric, 11 mm. long, 1.5 mm. in diameter, dilated in the throat; corolla lobes 6 to 8 mm. long, linear-oblong or oblong, obtuse or acutish; anthers sessile, oblong or oblong-cuneate, 1 mm. long, each lobe with a slender pubescent appendage slightly longer than the body of the anther; style slender, 6 to 7 mm. long; stigma discoid, obscurely tuberculate, 1 mm. in diameter; capsule lanceolate in outline, attenuate upward, 5 mm. long, sessile.

Type in the U. S. National Herbarium, no. 600079, collected around San Andrés de la Sierra, western slope of the Cordillera de Santa Marta, State of Magdalena, Colombia, altitude 1,100 to 1,300 meters, June 1 to 6, 1906, by H. Pittier (no. 1676).

Because of its appendaged anthers this falls at once into the subgenus *Leianthostemon*, but it differs from the species heretofore included in that group in having the anthers sessile. It slightly resembles *L. sulphurea* (Progel) Gilg, but the form of the corolla and calyx is very different. *Leiphaimos oreophila* has a higher altitudinal range than most species of the genus, the greater number of them being natives of lowland forests.

### THE GENUS SOMMERA.

The genus *Sommeria*, a member of the Rubiaceae, was published by Schlechtendahl in 1835,<sup>1</sup> a single species, *S. arborescens*, being described, based upon a plant collected in Mexico by Schiede. An-

<sup>1</sup> *Linnaea* 9: 602. 1835.



other species was described by Schumann in 1889, from northwestern Brazil.

Heretofore all material of this genus from Central America has been referred, without hesitation, to *Sommeria arborescens*. Examination of a sheet of the type collection in the U. S. National Herbarium shows that the Mexican plant is very different from any of the Central American specimens. Schlechtendahl states that in his specimens the cymes are 3 to 5-flowered and in our Mexican specimens this number is never exceeded, while the flowers are closely aggregated at the end of the peduncle. All of our other specimens, however, have an open, broad, many-flowered cyme.

The most striking peculiarity of the genus is the lineolate appearance of the tissue between the reticulate veins. This is characteristic, also, of the closely related genus *Watsonamra*, several species of which are found in Central America.

## KEY TO THE SPECIES.

- Style glabrous at the apex----- 1. *S. sabiceoides*.  
 Style pilose at the apex.  
   Cymes 3 to 5-flowered; calyx lobes lanceolate or oblong-lanceolate, acuminate----- 2. *S. arborescens*.  
   Cymes many-flowered; calyx lobes oblong to broadly oblong or ovate, from broadly rounded to merely acute at the apex.  
     Bracts of the inflorescence broadly ovate to oblong, obtuse or shortly and abruptly acuminate; calyx lobes longitudinally veined, the veins not conspicuously reticulate; peduncles slender, 2 to 5 cm. long----- 3. *S. guatemalensis*.  
     Bracts of the inflorescence lance-ovate to linear, attenuate or long-acuminate at the apex; calyx lobes conspicuously reticulate-veined; peduncles stout, 8 to 15 mm. long.  
       Leaf blades oval to broadly oblong-obovate, not more than twice as long as broad, round or broadly cuneate at the base, pubescent beneath with very short appressed hairs, the surface not velvety to the touch; bracts lance-ovate or lanceolate, without green tips; corolla tube sparingly pubescent outside----- 4. *S. donnell-smithii*.  
       Leaf blades oblanceolate to elliptic-oblanceolate or rarely obovate, usually much more than twice as long as broad, cuneate to attenuate at the base, pubescent beneath with long and usually spreading hairs, somewhat velvety to the touch; bracts mostly linear or lance-linear, with green tips; corolla tube densely pubescent outside----- 5. *S. mesochora*.



1. *Sommerera sabiceoides* Schum. in Mart. Fl. Bras. 6<sup>e</sup>:300. pl. 133. f. 1. 1889.

The type was collected by Martius along the River Yapurá, State of Amazonas, northwestern Brazil. Apparently, it is known only from this single collection.

2. *Sommerera arborescens* Schlecht. Linnaea 9: 602. 1835.

Type collected by Schiede (no. 272) near the Hacienda de la Laguna, southern Mexico.

ILLUSTRATIONS: Schum. in Engler & Prantl, Pflanzenfam. 4<sup>i</sup>: f. 26. J, K.

SPECIMENS EXAMINED:

MEXICO: Hacienda de la Laguna, *Schiede* 272, type collection. Barranca Tenampa, near Zacuapan, Vera Cruz, in damp forests, *Purpus* 2062.

3. *Sommerera guatemalensis* Standley, sp. nov.

Young branches terete or nearly so, succulent, sparingly strigose; stipules narrowly lanceolate, 35 to 45 mm. long, long-attenuate, thin, brown, strigose along the midvein and margin; petioles 2 to 5 cm. long, strigose; leaf blades oblong-obovate to oval, 17 to 32 cm. long, 8 to 14 cm. wide, rounded to broadly cuneate at the base, abruptly short-acuminate, the tip 15 to 20 mm. long, acute, densely strigose on both surfaces when young, in age glabrate on the upper surface, strigose beneath with very short hairs; peduncles relatively slender, 2 to 5 cm. long, many-flowered, the flowers in a rather dense cyme with several branches; bracts broadly ovate to oblong, obtuse or abruptly acuminate, thin, brown, finely parallel-veined, strigose along the midnerve, ciliate; flowers sessile or very shortly pediceled; ovary densely strigose; calyx lobes 3 to 6 mm. long, unequal, oval to broadly ovate, obtuse or acute, longitudinally nerved, finely strigillose on both surfaces; corolla tube 6 to 8 mm. long, densely pubescent outside above the calyx, densely villous within above the middle, the lobes one-fifth to one-third as long as the tube, triangular-ovate, acute; filaments inserted about the middle of the tube, somewhat longer than the oblong anthers; pistil stout, pilose above; fruit elongate-spherical, 12 mm. long and 9 or 10 mm. in diameter, sparingly strigose, capped with the persistent calyx.

Type in the U. S. National Herbarium, no. 398487, collected near Cubilquitz, Department of Alta Verapaz, Guatemala, altitude 350 meters, May, 1902, by H. von Türekheim (J. D. Smith, no. 8225).

ADDITIONAL SPECIMENS EXAMINED:

GUATEMALA: Pansamalá, Department of Alta Verapaz, alt. 1,140 meters, April, 1889, *J. D. Smith* 1737.

Distinguished from the other Central American species by the broad bracts and the long peduncles, as well as by the large and broad leaves.

4. *Sommerera donnell-smithii* Standley, sp. nov.

Branches stout, terete, densely pubescent with long ascending tawny hairs; stipules 15 to 20 mm. long, lanceolate or ovate-lanceolate, acuminate, thin, brown, strigose along the midvein and margins or glabrate, ciliate; petioles 1 to 2 cm. long, densely strigose with tawny hairs; leaf blades oval to oval-obovate, 11 to 20 cm. long, 5 to 10 cm. wide, abruptly acuminate, the tips 15 to 20 mm. long, acute, rounded or broadly cuneate at the base, glabrous or remotely strigillose on the upper surface, sparingly pubescent beneath with very short appressed hairs, strigose-ciliate; peduncles 9 to 12 mm. long, stout, densely pubescent with tawny, appressed or ascending hairs; cymes many-flowered, with several stout divaricate branches, the flowers crowded at the ends of the branches, nearly sessile, but the pedicels in fruit 3 to 8 mm. long; bracts lanceolate to lance-ovate, acute to attenuate, thin, brown, strigose; ovary densely strigose; calyx lobes 3 mm. long or less, broadly oval or oblong, rounded at the



apex or obtuse, sparingly strigose, green, conspicuously reticulate-veined; corolla 5 to 7 mm. long, the tube minutely strigillose outside, densely villous within, the lobes about one-fourth as long as the tube, ovate, obtuse; style almost glabrous; fruit nearly spherical, 9 mm. in diameter, sparingly strigose.

Type in the U. S. National Herbarium, no. 245836, collected near Alajuelita, Province of San José, Costa Rica, altitude 990 meters, March, 1894, by John Donnell Smith (no. 4771).

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: Alajuela, Province of Alajuela, alt. 900 meters, March, 1896, *J. D. Smith* 6592.

5. *Sommeria mesochora* Standley, sp. nov.

Tree, about 8 meters high; young branches stout, terete, densely pubescent with loose tawny hairs; stipules 20 to 35 mm. long, lance-ovate, attenuate, thin and scarious, sparingly strigose along the midnerve and margins, strigose-ciliate; petioles 10 to 25 mm. long, densely pubescent with long loose hairs; leaf blades 12 to 22 cm. long, 3.5 to 8 cm. wide, oblong-oblongeolate to oblong-obovate, acuminate, sometimes rather abruptly so, gradually tapering from one-third the distance below the apex to a cuneate or very acute base, sparingly pubescent on the upper surface with very short appressed hairs, beneath rather densely pubescent with long, slender, loose or spreading, whitish hairs, ciliate; peduncles 10 to 15 mm. long, densely pilose; cymes many-flowered, with several divaricate branches, the flowers rather densely clustered at the ends of the branches, short-pedicelled; bracts linear or lance-linear, the tips green, conspicuously reticulate-veined, abundantly pubescent with long loose hairs; ovary densely pubescent with long loose whitish hairs; calyx lobes 3 to 4 mm. long, oblong to broadly ovate, acutish to broadly rounded at the apex, strigose, conspicuously reticulate-veined; corolla white, 5 to 8 mm. long, densely and finely pubescent outside, loosely villous inside, the lobes one-fourth to one-third as long as the tube, oblong, obtuse or acutish; style densely pilose at the apex; filaments inserted near the middle of the tube, about as long as the anthers; fruit not seen.

Type in the U. S. National Herbarium, no. 675326, collected in a wet forest ravine, near El Boquete, Chiriquí, Panama, altitude 1,000 to 1,300 meters, March 2 to 8, 1911, by William R. Maxon (no. 4941).

ADDITIONAL SPECIMENS EXAMINED:

PANAMA: Near El Boquete, Chiriquí, alt. 1,000 to 1,300 meters, *Pittier* 3137.

COSTA RICA: Las Cruces de Boruca, February 19, 1898, *Pittier* (Inst. Fís. Geogr. Costa Rica, no. 12071). Cañas Gordas, alt. 1,100 meters, February, 1897, *Pittier* (Inst. Fís. Geogr. Costa Rica, no. 11155).

This is closely related to the preceding species, but seems distinct in its long, narrow leaves of different outline, the densely pilose style, the long and loose pubescence, and the narrow, green bracts.

### NOTHOPHLEBIA, A NEW GENUS OF RUBIACEAE FROM COSTA RICA.

Among the plants in the U. S. National Herbarium collected in Costa Rica by Mr. H. Pittier the writer has found one which at first glance recalls the genus *Watsonamra*, especially in the form of the leaves, these having the lineolate appearance or "Moiréestreifung" characteristic of a group of four genera of the tribe Musaeendae. Although the specimen is only in flower, the form of the ovary clearly indicates that the plant is a member of this tribe, but



the form of the flowers is so different from that of *Hippotis*, *Sommera*, *Watsonamra*, or *Tammsia*, that the Costa Rican plant must become the type of a new genus.

**NOTHOPHLEBIA** Standley, gen. nov.

Tree with large opposite leaves, these petiolate, the blades leathery, entire, nearly glabrous, the leaf tissue finely lineolate between the veins; stipules large, distinct; flowers bracteate, rather large, in axillary many-flowered pedunculate cymes; calyx tube campanulate, as broad as long, very obscurely 5-lobed, the margins faintly crenulate, naked within; corolla funnelform, the tube gradually widening upward, the 5 lobes valvate, much shorter than the tube, leathery; stamens 5, inserted near the base of the tube, the filaments slender, flexuous, unequal, pilose at the base, the anthers introrse, oblong, attached near the base, obtuse at the apex, caudate at the base, included; disk cupulate, 5-lobed; ovary 2-celled, the ovules numerous, compressed, inserted on elongated placentæ adnate to the septum; style slender; stigmas oblong or lanceolate.

*Nothophlebia* is most nearly related to *Watsonamra*, but it differs decidedly in the form of the calyx, that genus having a tubular and conspicuously toothed calyx or a tubular-campanulate and deeply lobed one. The corollas are very different in the two, the tube being cylindric in *Watsonamra* and obconic in *Nothophlebia*.

The name refers to the striæ of the leaves, which falsely appear to be a part of the venation.

***Nothophlebia costaricensis*** Standley, sp. nov.

Tree with a depressed crown; young branches stout and fleshy, obtusely quadrangular, glabrous; stipules 35 to 40 mm. long, lance-oblong, attenuate, sparsely strigillose-puberulent, glabrous within; petioles stout, 40 to 55 mm. long, nearly glabrous, sparingly tuberculate near the base; leaf blades oval or obovate-oval, about 33 cm. long and 17 cm. wide, obtuse, acuminate at the base, leathery, glabrous, or very obscurely pubescent upon the veins beneath with appressed hairs, the veins prominent, about 12 on each side, dichotomous near the margin; cymes many-flowered, loosely branched, the branches minutely puberulent and tuberculate, the peduncle 2 cm. long and the secondary branches of about the same length; pedicels 7 mm. long or less, some of the flowers sessile; bractlets at the base of the flowers subulate, 2 mm. long; ovary turbinate, 4 mm. long, strigillose; calyx 4 to 5 mm. long and of about the same diameter, minutely puberulent outside, glabrous within; corolla tube 2 cm. long, 3.5 mm. thick at the base, expanding to 8 or 9 mm. in the throat, glabrous outside near the base, puberulent above, glabrous within except at the point of insertion of the stamens, there pilose; corolla lobes spreading, ovate, acute or acutish, 4 to 5 mm. long, densely puberulent outside, glabrous within or nearly so; filaments inserted 2 mm. above the base of the tube, 9 to 10 mm. long; anthers 2.5 long; style 1 cm. long, the stigmas about 2 mm. long.

Type in the U. S. National Herbarium, no. 578472, collected on Collines de Moin, Atlantic coastal belt, Costa Rica, November, 1899, by H. Pittier (Inst. Ffs. Geogr. Costa Rica, no. 16024).

Only a few bracts are present upon the inflorescence, showing that they are early deciduous. There is no indication that any are ever present except at the base of the ovary or pedicel.



## A REVISION OF THE GENUS WATSONAMRA.

The name *Pentagonia* was applied by Bentham in 1844 to a rubiaceous plant collected by Hinds in Panama, which he called *Pentagonia macrophylla*. Unfortunately this generic name had been used twice before, *Pentagonia* having been applied by Ventenat in 1841 to a member of the Campanulaceae and *Pentagonium* by Schauer in 1843 to an asclepiad.

In the Kew Index, as well as in Dalla Torre and Harms's *Genera Siphonogamarum*, *Seemannia* of Hooker<sup>1</sup> is cited as a synonym of *Pentagonia*, dating from 1848. Upon investigating this reference one finds that *Seemannia* was scarcely published here, Hooker merely saying in discussing *Pentagonia pinnatifida*, " \* \* \* should future observations discover marks sufficient to constitute of our present plant a new genus, I can not but wish it should have the name of its discoverer, *Seemannia*." A genus of the Gesneriaceae was named *Seemannia* by Regel in 1855.

The two works cited also list *Megaphyllum* Spruce as a synonym of *Pentagonia*, but this was cited by Baillon as a synonym,<sup>2</sup> hence is not published. It is not clear what the plant is to which Spruce applied the name of *Megaphyllum*, for the writer has not found a citation in literature of Spruce's number mentioned by Baillon.

Otto Kuntze, in 1891, finding the rubiaceous group to be without a name, designated it as *Watsonamra*, in honor of Dr. Sereno Watson. This is the name that apparently must stand for the genus.

Heretofore six species of *Pentagonia*, or *Watsonamra*, have been described from Central America and northwestern South America. The recent collections of this genus in Panama comprise a more extended series of specimens than has been brought together heretofore. Among the collections of Mr. Pittier and Mr. Williams the writer has found four plants that seem different from those already described. A plant from Costa Rica, distributed as *Pentagonia wendlandi*, also appears to be new. Thus the number of known species is increased to eleven.

*Watsonamra* is remarkable because of the venation of the leaf blades, the tissue being finely lineolate between the reticulate veins. When a piece of the blade is broken, the fragments are held together by the fine white threads drawn from the striæ. The genus is not peculiar in this respect, a few other members of the family exhibiting the same structure. It is remarkable, however, in containing the only members of the Rubiaceae which have pinnatifid leaves.

<sup>1</sup> Lond. Journ. Bot. 7: 567. 1848.

<sup>2</sup> Hist. Pl. 7: 456. 1880.



## WATSONAMRA Kuntze.

*Pentagonia* Benth. Bot. Voy. Sulph. 105. pl. 39. 1844, not Vent. 1841.

*Watsonamra* Kuntze, Rev. Gen. Pl. 1: 302. 1891.

Type species, *Pentagonia macrophylla* Benth.

## KEY TO THE SPECIES.

Leaves entire.

Leaf blades sessile or subsessile.

Corolla red, the lobes spreading; calyx lobes not  
more than half as long as the tube----- 1. *W. magnifica*.

Corolla yellow, the lobes erect; calyx lobes as  
long as the tube----- 2. *W. wendlandi*.

Leaf blades on long petioles.

Calyx not glandular within----- 3. *W. spathicalyx*.

Calyx glandular within.

Leaves finely soft-pubescent on both sur-  
faces; corolla hirtellous----- 4. *W. pubescens*.

Leaves glabrous, or the veins beneath ap-  
pressed-pubescent; pubescence of the  
corolla appressed.

Bracts deciduous; corolla lobes oblong,  
twice as long as broad, densely  
pubescent outside; calyx tube  
campanulate ----- 5. *W. donnell-smithii*.

Bracts persistent; corolla lobes ovate,  
nearly as broad as long, sparsely  
pubescent; calyx tube turbinate-- 6. *W. macrophylla*.

Leaves pinnatifid.

Petioles not auriculate at the base.

Inflorescence closely sessile, many-flowered;  
petioles winged to the base; fruit densely  
tuberculate----- 10. *W. tinajita*.

Inflorescence short-pedunculate, few-flowered;  
petioles winged on the upper half, naked  
below; fruit sparsely tuberculate----- 11. *W. gymnopoda*.

Petioles auriculate at the base.

Calyx 30 mm. long, tubular, appendaged within  
at the base, the lobes 3 mm. long or less;  
corolla only slightly exceeding the calyx-- 7. *W. pinnatifida*.

Calyx 12 to 20 mm. long, cylindric-campanulate  
or tubular, not appendaged within, the  
lobes one-third as long as the tube or  
longer; corolla twice as long as the calyx  
or longer.

Auricles nearly half as long as the petioles;  
calyx tubular, 20 mm. long, the lobes  
one-third as long as the tube; inflor-  
escence many-flowered; bracts oblong  
or narrowly oblong, 10 to 20 mm. long-- 8. *W. pittieri*.

Auricles less than one-fourth as long as the  
petioles; calyx cylindric-campanulate,  
15 mm. long, the lobes half as long as  
the tube; bracts broadly ovate, 5 to 10  
mm. long ----- 9. *W. brachyotis*.



1. *Watsonamra magnifica* (Krause) Standley.*Pentagonia magnifica* Krause, Bot. Jahrb. Engler 40: 325. 1908.

TYPE LOCALITY: Along the Rio Timbiqué, Colombia.

RANGE: Panama and Colombia.

## SPECIMENS EXAMINED:

COLOMBIA: Along the Rio Timbiqué, March, 1889, *Lehmann* 8886, type collection (in herb. N. Y. Bot. Gard.).PANAMA: Along the Rio Culebra, above Santa Isabel, Province of Colon, near sea level, *Pittier* 4158.

It is impossible to be certain that the Panama specimen is of this species, since it is in fruit, and even the persistent calyces are mutilated so that their form can not be determined definitely. Krause describes the fruit as being perfectly spherical and 12 to 15 mm. in diameter. In the Panama plant it is ovoid-spherical, about 22 mm. in diameter and 24 to 28 mm. high, and finely striate longitudinally. The specimen of the type collection in the herbarium of the New York Botanical Garden has no fruit. The inflorescence is described as sessile, but in this specimen the peduncle is a centimeter long. In the plant from Panama the peduncles are even longer. It is very probable that, when the flowers of the latter are collected, it will be found to be an undescribed species. The single leaf of Mr. Pittier's collection is 78 cm. long and 29 cm. wide in the broadest part.

2. *Watsonamra wendlandi* (Hook.) Kuntze, Rev. Gen. Pl. 1: 302. 1891.*Pentagonia wendlandi* Hook. Curtis's Bot. Mag. 87: pl. 5230. 1861.

TYPE LOCALITY: The plant was described from cultivated specimens. Hooker states that it was brought by Wendland from some part of Central America. Hemsley<sup>1</sup> gives the locality as Central Mexico, but this is probably a slip of the pen for Central America, since many such lapses are found in the *Biologia*.

3. *Watsonamra spathicalyx* (Schum.) Kuntze, Rev. Gen. Pl. 1: 302. 1891.*Pentagonia spathicalyx* Schum. in Mart. Fl. Bras. 6<sup>a</sup>: 302. 1889.

TYPE LOCALITY: In forests along the River Yapurá and near Ega, State of Amazonas, northwestern Brazil. Type collected by Martius.

Described from fruiting specimens; the corolla has not been seen.

4. *Watsonamra pubescens* Standley, sp. nov.

A small tree, 3 to 4 meters high; young branches thick and succulent, hirtellous; stipules not seen; petioles naked, 4 to 10 cm. long, densely hirtellous with short hairs; leaf blades oval-obovate to elliptic-oval, 26 to 48 cm. long, 12 to 23 cm. wide, acute, rounded to acute at the base, densely pubescent on both surfaces with fine short spreading hairs, velvety to the touch, conspicuously veined, with 12 to 14 veins on each side, these branching near the margin; cymes subsessile or the peduncles 5 mm. long, few-flowered, the branches densely pubescent; pedicels 2 or 3 mm. long, very stout; bracts oblong to broadly ovate, 10 to 15 mm. long, obtuse, finely nerved, appressed-pubescent on the outer surface; ovary 6 mm. long; calyx about 18 mm. long, the tube turbinate, densely pubescent with appressed hairs, the lobes rounded at the apex, sparingly pubescent on the outer surface, the tube glandular within; corolla tube slenderly cylindric, 25 mm. long, 3.5 mm. in diameter, hirtellous outside, villous within, the lobes ovate, acute, 5 mm. long; stamens inserted 7 mm. above the base of the tube, the filaments slender, villous; style 18 mm. long, pilose above; immature fruit spherical, 12 to 14 mm. in diameter, crowned by the persistent and accrescent calyx, vertically striate, densely hirtellous.

<sup>1</sup> Biol. Centr. Amer. Bot. 2: 38. 1881.



Type in the U. S. National Herbarium, no. 678894, collected along the railroad near Tabernilla, Canal Zone, Panama, altitude 20 to 25 meters, July 6, 1911, by H. Pittier (no. 3822).

Easily distinguished from all other species by the densely pubescent leaves and hirtellous corolla.

5. *Watsonamra donnell-smithii* Standley, sp. nov.

Young branches stout, glabrate or sparingly strigillose; stipules about 5 cm. long and 2.5 cm. broad, ovate, acuminate or attenuate, densely and finely silky-strigillose on the outer surface, glabrous on the inner surface; petioles 9 to 11 cm. long, minutely strigillose, naked; leaf blade (a single one seen) entire, oval, 45 cm. long, 28 cm. wide, obtuse at the base, glabrous above, glabrous beneath except along the finely silky-strigose veins, these conspicuous, 14 on each side; cymes rather densely many-flowered, on stout peduncles 10 to 13 mm. long; bracts not seen, evidently early deciduous, or possibly wanting; pedicels very stout, 4 to 6 mm. long; ovary densely appressed-pubescent; calyx 12 to 15 mm. long, the tube campanulate, 5 to 7 mm. broad, finely pubescent with appressed hairs, glandular within near the base, the lobes about equaling the tube, obovate or oval-obovate, rounded at the apex, finely striate, sparingly pubescent outside, glabrous within; corolla tube 25 mm. long, 3.5 mm. in diameter, densely pubescent outside with short appressed hairs, except near the base, there glabrous, nearly glabrous within; corolla lobes 6 or 7 mm. long, oblong, about twice as long as broad, pubescent outside like the tube, but more densely so, glabrate within; stamens inserted 6 mm. above the base of the corolla tube, the slender filaments unequal, 11 mm. long or less, villous near the base; fruit not seen.

Type in the U. S. National Herbarium, no. 355176, collected near La Emilia, Llanuras de Santa Clara, Costa Rica, altitude 250 meters, April, 1896, by John Donnell Smith (no. 6590).

This was distributed as *Pentagonia wendlandi*, but is very unlike that plant. It is most closely related to *Watsonamra macrophylla*, but that species has persistent bracts, broader corolla lobes, and a very different calyx. The peduncles, pedicels, and bases of the petioles in the type are very densely beset with brownish, gland-like tubercles. A few similar tubercles are found on some of the specimens of closely related species.

6. *Watsonamra macrophylla* (Benth.) Kuntze, Rev. Gen. Pl. 1: 302. 1891.

*Pentagonia macrophylla* Benth. Bot. Voy. Sulph. 105. pl. 39. 1844.

TYPE LOCALITY: Panama. Type collected by Hinds.

RANGE: Canal Zone and vicinity, Panama.

SPECIMENS EXAMINED:

CANAL ZONE: Agua Clara, on the Trinidad River, alt. 10 to 40 meters, Pittier 3992. Matachín, June, 1874, Kuntze. Culebra, Cowell 217. Colon to Empire, Joseph Crawford 512.

Three meters high or less; leaves 25 to 60 cm. long; calyx red; corolla greenish.

7. *Watsonamra pinnatifida* (Seem.) Kuntze, Rev. Gen. Pl. 1: 302. 1891.

*Pentagonia pinnatifida* Seem. Lond. Journ. Bot. 7: 566. pl. 18. 1848.

TYPE LOCALITY: Banks of the River Cupica, State of Cauca, Colombia. Type collected by Seemann.

A small tree, about 3 meters high; larger leaves nearly a meter long and half as wide. This differs from all other species in the narrowly tubular corolla which extends only slightly beyond the calyx and in the peculiar interior appen-



dages of the calyx. It may be the type of a distinct genus, as suggested by Hooker, but in general appearance it is very similar to the other species with pinnatifid leaves.

**8. *Watsonamra pittieri* Standley, sp. nov.**

Stems stout and succulent, obtusely quadrangular, glabrate; stipules 55 mm. long, narrowly oblong, rather abruptly attenuate, finely pubescent outside with minute appressed hairs, glabrous within; petioles 14 to 17 cm. long, stout, smooth, minutely puberulent with appressed hairs, auriculate at the base, the purplish red auricles rounded, crispate, about 8 cm. long, undulate-margined, finely and sparsely strigose-puberulent, especially on the lower surface; leaf blades 68 cm. long or less (in the specimens), up to 58 cm. wide, truncate or obtuse at the base, pinnatifid about two-thirds the distance to the midrib, the lobes 4 or 5 on each side, ascending or subdivergent, narrowly oblong, acute or abruptly acute, the terminal lobe broader than the others, the blade glabrous throughout or minutely strigose-puberulent on the veins beneath; cymes few-flowered, on stout peduncles 25 mm. long or less; bracts oblong or narrowly oblong, 10 to 20 mm. long, acute, persistent, striate, finely appressed-pubescent outside, glabrous within, ciliate; flowers subsessile; calyx tubular, 20 mm. long, silky-strigose outside, glabrous and naked within, the lobes one-third as long as the tube or shorter, oblong-ovate, obtuse or acutish, ciliate; corolla tube much exserted (a perfect corolla not seen), sparingly puberulent; fruit subspherical, about 2 cm. in diameter, striate vertically, not tuberculate, strigose-puberulent.

Type in the U. S. National Herbarium, no. 679414, collected in forests around Puerto Obaldía, San Blas Coast, Panama, at an altitude of 50 meters or less, August, 1911, by H. Pittier (no. 4298). Additional material is mounted on sheet 679415.

The leaves of this species agree very well with those figured and described for *Watsonamra pinnatifida*. The form of the calyx, however, is very different in the two. Only a single mutilated corolla of *W. pittieri* has been seen, but this is sufficient to show that it is very unlike that of *W. pinnatifida*.

**9. *Watsonamra brachyotis* Standley, sp. nov.**

A small tree 3.5 meters high, the trunk 2.5 cm. in diameter; wood yellowish white; bark on the older stems grayish, slightly furrowed; young branches succulent, glabrous or nearly so; stipules not seen; petioles 8 to 10 cm. long, slender, strigose-puberulent, each bearing at the base 2 rounded reddish auricles 2.5 cm. long or less, these crispate, undulate-margined, strigose-puberulent; leaf blades (in the specimens examined) rhombic in outline, 33 to 37 cm. long, 42 to 46 cm. broad, obtuse at the base, glabrous on the upper surface, glabrous beneath except for the strigillose veins, pinnatifid nearly to the midvein, the lobes 3 on each side, narrowly oblong, 4 to 6 cm. wide, acuminate, the tips obtuse, the terminal lobe broader, oval-oblong or ovate; cymes closely few-flowered, very shortly pedunculate; bracts persistent, broadly ovate, 5 to 10 mm. long, acute or acutish, striate, brown, sparingly silky-strigose, ciliate; calyx cylindric-campanulate, 15 mm. long or less, sparingly silky-strigillose, the lobes half as long as the tube or more, ovate or oval, rounded at the apex, ciliolate; corolla tube slender, 30 mm. long, nearly glabrous outside, but with a few appressed hairs, glabrous within except at the insertion of the anthers, there pilose; corolla lobes spreading, 3 to 4 mm. long, ovate, acute or acutish; stamens inserted 8 mm. above the base of the tube, the filaments slender, pilose at the base, 10 mm. long or less; style 15 to 20 mm. long; fruit not seen.



Type in the U. S. National Herbarium, no. 678351, collected near Marraganti, Panama, April 3, 1908, by R. S. Williams (no. 999). Duplicate type in the herbarium of the New York Botanical Garden.

This is closely related to the preceding species, but seems amply distinct in the short auricles, short, broad calyx, broader and shorter bracts, and few-flowered cymes. The collector states that the leaves are sometimes a meter long and that the flowers are red.

**10. *Watsonamra tinajita* (Seem.) Kuntze, Rev. Gen. Pl. 1: 302. 1891.**

*Pentagonia tinajita* Seem. Bot. Voy. Herald 134. pl. 28. 1854.

TYPE LOCALITY: Near David, Province of Chiriquí, Panama. Type collected by Seemann (no. 1595).

RANGE: Province of Chiriquí, Panama.

SPECIMENS EXAMINED:

PANAMA: Vicinity of David, Chiriquí, alt. 30 to 80 meters, *Pittier* 3369.

Vicinity of San Felix, eastern Chiriquí, alt. 0 to 120 meters, *Pittier* 5214.

A small tree, 2 to 4 meters high. According to Seemann, the native name is "tinajita" and the fruit is edible, but of an insipid flavor. The fruits are 10 to 17 mm. in diameter and densely tuberculate. The seeds are about 3 mm. long, obtusely angled, and few.

**11. *Watsonamra gymnopoda* Standley, sp. nov.**

A shrub. 2 to 2.5 meters high; young stems fleshy, stout, obtusely quadrangular, glabrous or nearly so; stipules 3 to 6 cm. long, oblong-ovate or lance-oblong, acuminate or attenuate, silky-strigillose outside, glabrous within; petioles 7 to 23 cm. long, slender, naked below, winged on the upper half, the wings 15 mm. wide or less, strigillose-puberulent or glabrate; leaf blades 54 to 68 cm. long, 66 to 72 cm. wide, ovate-triangular in outline, glabrous above, strigillose-puberulent along the veins beneath, pinnatifid nearly to the midrib, with 4 to 6 divisions on each side, these divergent, oblong-linear, 6.5 cm. wide or less, narrowed toward the base, gradually tapering toward the acute apex, prominently veined, the terminal one short and only slightly broader than the others; cymes densely few-flowered, on stout peduncles 6 to 9 mm. long; bracts oblong, obtuse or acute, 23 mm. long or less, sparingly strigillose-puberulent outside, ciliate; flowers not seen; fruit globose-ovoid, 14 mm. in diameter and 18 mm. high, sparsely tuberculate and puberulent, not striate; seeds numerous, brown, obtusely angled, minutely favose, 3 to 4.5 mm. long.

Type in the U. S. National Herbarium, no. 678935, collected in forests, Loma de Gloria, near Fató, Province of Colon, Panama, altitude 10 to 100 meters, in July or August, 1911, by H. Pittier (no. 3858). Additional material, consisting of young leaves, is mounted on sheet 678934.

This is most closely related to *Watsonamra tinajita*, but the petioles are not winged to the base, as in that species, the leaf segments are narrower, the inflorescence is pedunculate and fewer flowered, and the fruit is larger, of a different shape, and not densely tuberculate.

## GEOCARDIA, A NEW NAME TO REPLACE GEOPHILA.

The name *Geophila* Don, applied in 1825 to a group of herbaceous plants of the family Rubiaceae, is antedated by *Geophila* Bergeret, given in 1803 to a member of the Liliaceae. No other name seems



ever to have been applied to the rubiaceous genus, although Mueller considered the species congeneric with *Mapouria* Aubl.<sup>1</sup> The genus being clearly distinct, the writer proposes the name *Geocardia* (alluding to the heart-shaped leaves borne on prostrate stems) as a substitute for the homonym *Geophila*.

**GEOCARDIA** Standley, nom. nov.

*Geophila* D. Don, Prodr. Fl. Nepal. 136. 1825, not Berg. 1803.

The following is a list of the principal American species. Several others have been described from Africa:

***Geocardia cordata*** (Miq.) Standley.

*Geophila cordata* Miq. Linnaea 17: 72. 1843.

*Mapouria cordata* Muell. Arg. in Mart. Fl. Bras. 6<sup>5</sup>: 426. 1881.

***Geocardia herbacea*** (L.) Standley.

*Psychotria herbacea* L. Sp. Pl. ed. 2. 245. 1762.

*Cephaelis reniformis* H. B. K. Nov. Gen. & Sp. 3: 377. 1818.

***Geocardia macrocarpa*** (Muell. Arg.) Standley.

*Mapouria macrocarpa* Muell. Arg. in Mart. Fl. Bras. 6<sup>5</sup>: 425. 1881.

***Geocardia picta*** (Rolfe) Standley.

*Geophila picta* Rolfe, Kew Bull. 1896: 18. 1896.

***Geocardia pleuropoda*** (Donn. Smith) Standley.

*Geophila pleuropoda* Donn. Smith, Bot. Gaz. 52: 50. 1911.

***Geocardia tenuis*** (Muell. Arg.) Standley.

*Mapouria tenuis* Muell. Arg. in Mart. Fl. Bras. 6<sup>5</sup>: 425. 1881.

***Geocardia violacea*** (Aubl.) Standley.

*Psychotria violacea* Aubl. Pl. Guian. 1: 145. pl. 55. 1775.

*Geophila violacea* DC. Prodr. 4: 537. 1830.

***Geocardia violaefolia*** (H. B. K.) Standley.

*Cephaelis violaefolia* H. B. K. Nov. Gen. & Sp. 3: 379. 1818.

*Geophila violaefolia* DC. Prodr. 4: 537. 1830.

*Geophila herbacea* Morong, Ann. N. Y. Acad. 7: 129. 1893.

*Geophila herbacea violaefolia* Chod. & Hassl. Bull. Herb. Boiss. II. 4: 180. 1904.

**NEW RUBIACEAE FROM COLOMBIA AND COSTA RICA.**

The following new species comprising one in each of the genera *Cassupa*, *Gonzalagunia*, *Genipa*, and *Cosmibuena*, have been noted in the large series of specimens collected by Mr. H. Pittier in Costa Rica and Colombia.

***Cassupa pittieri*** Standley, sp. nov.

Small pyramidal tree, 4 to 5 meters high; young branches stout, obtusely quadrangular, densely tomentulose with tawny hairs; stipules 7 to 12 mm. long, triangular-lanceolate, attenuate, puberulent outside; petioles 4 to 5 cm.

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<sup>1</sup> In Mart. Fl. Bras. 6<sup>5</sup>: 424. 1881.



long, stout, minutely puberulent; leaf blades oval, about 28 cm. long and 14 cm. wide, acuminate, abruptly short-acuminate at the base, the upper surface dark green and shining, glabrous except for the puberulent veins, beneath paler green, puberulent, especially along the veins, prominently nerved, about 22 parallel lateral veins on each side; panicle about 9 cm. long (excluding the corollas), many-flowered, the secondary branches stout, compressed, 25 mm. long or less, puberulent, the terminal flowers sessile, the others on pedicels 5 to 8 mm. long; bracts ovate to lanceolate, acute; ovary and calyx together 6 or 7 mm. long, glabrous or obscurely puberulent, the calyx margin minutely repand-denticulate; corolla white, the tube 57 mm. long, slightly dilated in the throat, glabrous and smooth near the base, above verrucose and puberulent, densely bearded within in the throat; corolla lobes 6, ovate or oval, 11 mm. long, 6 or 7 mm. wide, rounded or obtuse at the apex, puberulent, bearded within at the base, imbricated; filaments 3 mm. long; anthers 10 mm. long; style 55 mm. long, glabrous below, scaberulo-puberulent above; stigmas oblong, 5 mm. long; fruit not seen, the ovaries 2-celled.

Type in the U. S. National Herbarium, no. 530697, collected near Córdoba, Dagua Valley, State of Cauca, Colombia, in the Pacific coastal zone, altitude 30 to 100 meters, December, 1905, by H. Pittier (no. 514).

This resembles *Cassupa alba* Schum. & Krause in the color of its flowers, but the corolla is longer and is verrucose and puberulent outside and the leaves are green beneath instead of densely white-puberulent.

**Gonzalagunia rugosa** Standley, sp. nov.

Young branches terete, densely matted-tomentose with pale brownish hairs, becoming glabrate in age; stipules 3 to 4 mm. long, triangular, with subulate tips; petioles very stout, 4 to 7 mm. long, densely tomentose; leaf blades lanceolate or elliptic-lanceolate, 7 to 10 cm. long, 25 to 35 mm. broad, rather abruptly acuminate, rounded or obtuse at the base, thick and subcoriaceous, very conspicuously rugose, glabrous on the upper surface or tomentulose along the veins, densely matted-tomentose beneath with pale yellowish or brownish hairs; inflorescence a spike-like panicle 10 to 15 cm. long and about 1.5 cm. broad, on a peduncle 25 mm. long; bracts linear, about 7 mm. long, persistent, before anthesis divaricate and exceeding the branches of the panicle; flowers in short-pedunculate many-flowered approximate cymes; calyx 4-lobed, the lobes broadly triangular, obtuse, persistent, the calyx and ovary together about 1.5 mm. long, densely tomentose; pedicels about 1 mm. long; corolla 5 mm. long, densely tomentose outside, the tube stout-cylindric, the 4 lobes broadly rounded, villous within; filaments very short, inserted above the base of the tube; anthers oblong, 1.25 mm. long; style 3.5 mm. long, puberulent; stigma 4-lobed, capitate; fruit depressed-demispheric, 4-celled, 3 mm. in diameter, densely tomentose; seeds rather few, brown, favose.

Type in the U. S. National Herbarium, no. 531453, collected around Huila, an Indian village in the Rio Paez Valley, Tierra Adentro, State of Cauca, Colombia, altitude 1,600 to 1,900 meters, January, 1906, by H. Pittier (no. 1258).

Distinguished from the other South American species of the genus by the very short corolla, as well as by the long bracts and densely tomentose lower surface of the leaves.

**Genipa codonocalyx** Standley, sp. nov.

Tree; young branches stout and succulent, glabrous or nearly so; stipules triangular-ovate, 10 to 12 mm. long, abruptly acuminate; petioles short, 5 to 15



mm. long, cinereous-puberulent; leaf blades oblanceolate to oblong-oblanceolate, 12 to 17 cm. long, 4 to 7 cm. wide, abruptly short-acuminate, the obtuse tip 10 to 13 mm. long, attenuate to the base, shining and glabrous on the upper surface, dull beneath and hirtellous or puberulent along the veins, these prominent, 9 to 12 on each side; cymes sessile or nearly so, branched, many-flowered, the branches very stout, glabrate; bracts broadly ovate, obtuse, connate at the base; pedicels 3 to 7 mm. long; calyx and ovary together broadly campanulate, 5 to 9 mm. high, 6 to 9 mm. broad, glabrous, the truncate limb of the calyx with 5 minute and inconspicuous teeth; corolla tube 11 mm. long, gradually widening upward, glabrous outside for 3 mm. above the base, elsewhere densely pubescent with long tawny appressed hairs, long-bearded within; corolla lobes spreading, 15 mm. long, oblong-obovate or oval, rounded at the apex, densely sericeous outside, bearded on the lower half, especially along and near the midnerve; anthers subsessile, 15 mm. long, linear; style and stigma together 22 mm. long, the former papillose and bearded near the apex; fruit not seen.

Type in the U. S. National Herbarium, no. 577536, collected near Boca Matapalo, Pacific coastal belt, Costa Rica, at sea level, April 10, 1898, by H. Pittier (Inst. Fís. Geogr. Costa Rica, no. 12085). Corolla yellowish white; native name, *jagua*.

This differs from both *Genipa americana* and *G. caruto* in the short, broad calyx, as well as in the form of the bracts. The leaves are not densely pubescent beneath, as in the second species, nor glabrous, as in *G. americana*.

***Cosmibuena arborea* Standley, sp. nov.**

A tree, 8 to 12 meters high, glabrous throughout; young branches stout, somewhat fleshy, grayish brown; stipules not seen; petioles 20 to 25 mm. long; leaf blades elliptic-obovate or elliptic-oblong, 9 to 11 cm. long, 42 to 56 mm. wide, thick and leathery, shining on the upper surface, rounded at the apex, cuneate or broadly cuneate at the base, with 7 to 9 parallel veins on each side, these not conspicuous; inflorescence terminal, of about 5 sessile flowers; stipules ovate or rounded-ovate, 10 to 15 mm. long, obtuse, thin; ovary oblong, about 12 mm. long, contracted into a stout stipe as long or longer; calyx cylindric, 10 to 13 mm. long, cleft two-fifths the distance to the base, the teeth somewhat unequal, oblong-triangular, acute, the whole calyx circumscissile, glandular within near the base; corolla tube slender, 6 to 7 cm. long, 3 to 4 mm. in diameter, gradually dilated toward the throat; corolla lobes 5, narrowly oblong, obtuse, 25 to 30 mm. long, 8 to 11 mm. wide, yellowish white; anthers sessile or nearly so, attached near the base, 2 cm. long, mucronate at the apex, with 2 short appendages at the base; style about 65 mm. long; stigma bilamellate; ovules numerous, winged, the wings laciniate.

Type in the U. S. National Herbarium, no. 531184, collected near Espejuelo, Cauca Valley, State of Cauca, Colombia, altitude 1,000 meters, January, 1906, by H. Pittier (no. 985).

Flowers very fragrant.

Related to *Cosmibuena triflora* as closely as to any species, but readily distinguished by the narrow corolla lobes, very obtuse leaves with longer petioles, and longer calyces.



## A REVISION OF THE GENUS COBAEA.

The genus *Cobaea* of the Polemoniaceae as published by Cavanilles consisted of a single species, *C. scandens*, described from plants grown in the Royal Botanical Garden at Madrid from seeds received from Mexico. The only other generic name that has been given to a member of the group here discussed is *Rosenbergia*-Örst., published in 1856, based upon *Rosenbergia gracilis*, which came from Costa Rica. Örsted believed that his plant belonged to a genus distinct from *Cobaea*, because of the elongated linear corolla lobes. A second species of *Rosenbergia* was published by Karsten in 1858. If no other members of the group treated here had been discovered it might naturally be divided into two genera; but later explorations have revealed intermediate forms, *Cobaea aschersoniana* Brand, especially, standing almost exactly midway between the types of *Cobaea* and *Rosenbergia*.

In 1908 Mr. H. D. House transferred all the species of *Cobaea* to *Rosenbergia*,<sup>1</sup> claiming that Cavanilles's generic name was invalidated by *Cobaea* Necker, published in 1790. Necker's name was applied to a group of Linnæan species of *Lonicera* sometimes known as *Xylosteum*; but it appears to be a hyponym, since it is not associable by citation with a previously published species. Consequently the name *Cobaea* is to be retained for the genus with which it has always been associated.

*Cobaea* is unique among the Polemoniaceae in having the leaves terminated by tendrils. Some authors have placed it in the *Bignoniaceae*, while others have considered it the type of a distinct family, the *Cobaeaceae*.

The species are all inhabitants of humid mountain forests of tropical and subtropical North and South America, ranging from the State of Nuevo León in Mexico south through Central America to northern Chile, Venezuela, and northwestern Brazil. So far as now known the species are of local distribution. *Cobaea scandens*, the most generally known species, has been found only within a small area in southern Mexico. Although a wide geographical range has been ascribed to certain species, it is probable that this is the result of hasty or careless determinations. Several have been introduced into cultivation in Europe and *C. scandens* is often seen in North America.

There are only three accounts of the genus that attempt to be complete. The first was published by Hemsley in *The Garden* in 1880.<sup>2</sup> This is a popular discussion of the group, although there are

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<sup>1</sup> *Mulenbergia* 4: 22-25. 1908.

<sup>2</sup> 17: 352-353.



appended technical descriptions of two new forms. Hemsley lists 8 species. More recently the group has been monographed by Brand in Engler's *Pflanzenreich*.<sup>1</sup> Brand recognizes three sections which include 9 species and 1 subspecies. House, in the paper cited above, published a key to the known species, 11 in all, 1 of which he described as new. Examination of the material of the genus in the U. S. National Herbarium indicates the presence of several undescribed species, some of them very unlike any of these hitherto recognized. These new species, seven in all, are described in the accompanying enumeration, which includes all members of the genus so far as now known. It is probable that more extended exploration of the mountains of Central and South America will bring to light a number of additional species. The writer has seen no specimens from Colombia or Nicaragua, regions in which some of the species doubtless occur.

## COBAEA Cav.

*Cobaea* Cav. *Icon. Pl.* 1: 11. *pl.* 16, 17. 1791. (Name misspelled "Cobbea" by Andrews and "Cobea" by Desfontaines.)

*Rosenbergia* Örst. *Vid. Medd. Naturh. For. Kjøbenhavn* 1856: 30. 1856.

## KEY TO THE SPECIES.

Corolla lobes linear or with linear tip.

Calyx lobes densely long-villous; corolla lobes ovate at the base, abruptly contracted into a long linear tip----- 5. *C. aschersoniana*.

Calyx lobes glabrous or minutely pilose; corolla lobes either linear or tapering gradually from the base.

Stamens shorter than the corolla; corolla lobes bifid at the apex----- 2. *C. hookeriana*.

Stamens longer than the corolla; corolla lobes entire.

Corolla yellow; calyx segments villous-ciliate. 4. *C. gracilis*.

Corolla purple or greenish purple; calyx segments not villous-ciliate.

Calyx lobes minutely pilose, about equaling the corolla tube; stigmas very short; corolla lobes of about equal breadth throughout, obtuse. 1. *C. penduliflora*.

Calyx lobes glabrous, much longer than the corolla tube; stigmas elongated; corolla lobes tapering to the long-attenuate apex----- 3. *C. panamensis*.

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<sup>1</sup> 27: 24-29. 1907.



Corolla lobes ovate-triangular to orbicular, never with linear tips.

Calyx lobes broadly rounded at the apex, united for nearly half their length----- 18. *C. scandens*.

Calyx lobes acute to attenuate, united only at the base.

Corolla lobes ovate to triangular, acute or acuminate.

Calyx shorter than the corolla tube; corolla 5 cm. long or more, yellow----- 8. *C. lutea*.

Calyx longer than the corolla tube; corolla 4 cm. long or less, yellowish green.

Stems and calyx glabrous; leaflets acute, bright green----- 6. *C. viorna*.

Stems densely villous about the nodes; calyx lobes villous-ciliate; leaflets obtuse, glaucescent----- 7. *C. villosa*.

Corolla lobes suborbicular to rounded-ovate, rounded to obtuse at the apex.

Peduncles shorter than the leaves; leaflets 4 cm. long or less----- 11. *C. minor*.

Peduncles longer than the leaves; leaflets usually 5 to 10 cm. long.

Lowest pair of leaflets much reduced, stipule-like----- 17. *C. stipularis*.

Lowest pair of leaflets similar in size and form to the others.

Corolla 4 cm. long or less.

Calyx lobes half as long as the corolla, hirsute; leaflets obovate-oblong----- 10. *C. campanulata*.

Calyx lobes more than half as long as the corolla, glabrous; leaflets oblong---- 9. *C. triflora*

Corolla 5 to 7 cm. long. (Calyx lobes half as long as the corolla, or often much shorter.)

Lowest leaflets more or less auriculate, constricted above the base; calyx lobes glabrous.

Calyx lobes broadly oblong-ovate, 13 to 15 mm. wide; corolla 6 cm. long, the tube campanulate; peduncles solitary; leaflets acute or acuminate----- 15. *C. baurita*.

Calyx lobes lanceolate or ovate-lanceolate, 8 to 11 mm. wide; corolla 7 cm. long, the tube obconic, tapering to the base; peduncles 2 together or 2-flowered; leaflets obtuse----- 16. *C. pringlei*.



Lowest leaflets rounded to subcordate at the base, never auriculate, not constricted; calyx lobes pubescent.

Calyx lobes more than half as long as the corolla tube, glabrous outside; leaflets oval to elliptic----- 12. *C. trianaei*.

Calyx lobes much less than half as long as the corolla tube, pubescent over all or nearly all the outer surface; leaflets narrowly oblong, narrowed toward the apex.

Leaflets glabrous; calyx lobes sparsely puberulent----- 13. *C. pachysepala*.

Leaflets loosely villous beneath; calyx lobes densely tomentulose ----- 14. *C. tomentulosa*.

1. *Cobaea penduliflora* (Karst.) Hook. f. Curtis's Bot. Mag. 95: pl. 5757. 1869, as to name only.

*Rosenbergia penduliflora* Karst. Fl. Columb. 1: 27. pl. 14. 1858.

TYPE LOCALITY: Caracas, Venezuela.

RANGE: Venezuela. Brand also reports<sup>1</sup> collections from Ecuador and Peru. Whether they really are of this species, or belong to *C. hookeriana*, or are undescribed, can not be determined without an examination of the specimens.

ILLUSTRATIONS: Brand in Engl. Pflanzenreich 27: f. 8.

No collections of this have been seen by the writer, but it is so well portrayed in Karsten's colored plate (copied by Brand) that there can be no doubt concerning its characteristics. In his description of this species, Brand contradicts his key to the two species which he refers to his section *Rosenbergia*. *Cobaea penduliflora* and *C. gracilis* are distinguished in the key by a single character, the former having "flores virides," and the latter "flores lutei." In the description of *Cobaea penduliflora*, however, the corolla is described as "viridi-rubescens" and "sordide violaceis." The same author cites plate 5757 of the Botanical Magazine as representing this species, but his abbreviation of Karsten's description has not been so amended as to include the plant figured there.

2. *Cobaea hookeriana* Standley, sp. nov.

PLATE 26.

*Cobaea penduliflora* Hook. f. Curtis's Bot. Mag. 95: pl. 5757. 1869, not *Rosenbergia penduliflora* Karst. 1858.

Stems slender, glabrous; leaves 7 to 12 cm. long, the leaflets oblong, 35 to 50 mm. long, pale green, thin, acute or acuminate, obtuse to subcordate at the base, conspicuously petiolulate; peduncles solitary, 20 to 25 cm. long, the flowers pendulous; calyx segments united only at the base, 35 to 40 mm. long, narrowly oblong, acute or acuminate, glabrous, green; corolla pale green, 10 to 12.5 cm. long, the tube 20 to 25 mm. long, campanulate, the lobes broadly linear, 4 to 5 mm. broad, of about the same length throughout, undulate, bifid at the apex, the sinuses between the lobes acute; stamens spreading, the filaments 7.5 cm.

<sup>1</sup> In Engl. Pflanzenreich 27: 28. 1907.



long, purplish red, villous at the base, the anthers yellow, 15 to 20 mm. long; style filiform, green, longer than the corolla, the stigmas slender, 1 cm. long; disk thick, 5-lobed, the lobes again 2-lobed; ovary 3-celled; fruit not known.

The type of this species is plate 5757 of Curtis's Botanical Magazine, the present description being drawn from the plate and from the accompanying description by Hooker. The plant figured was grown at Kew from seeds sent from Caracas, Venezuela, by Mr. A. Ernst. It flowered in the Palm House of the Royal Gardens in December, 1868. The same illustration is reproduced by Hemsley as a text figure in volume seventeen of *The Garden*, page 353.

As soon as one places Hooker's plate beside the excellent one of *Rosenbergia penduliflora* published by Karsten, it is obvious that two very different plants are represented. *Cobaea hookeriana* differs from Karsten's species in the less acute leaflets, longer, glabrous calyx lobes, larger corolla, broad, bifid, pale green corolla lobes, acute sinuses, short stamens, and elongated stigmas. The fact that both plants come from Venezuela means nothing, when one considers the number of species of the genus found in Guatemala. Although the seeds from which Hooker's plant were grown were sent from Caracas, they may have come from some locality far distant from that city.

As stated under *Cobaea penduliflora*, Brand cites the Botanical Magazine plate as that species, although his description excludes it. Hemsley<sup>1</sup> attempts to reconcile the differences between the two plates, apparently, stating that the length of the stamens and the color of the corolla is variable.

EXPLANATION OF PLATE 26.—Photograph of plate 5757 of Curtis's Botanical Magazine.

### 3. *Cobaea panamensis* Standley, sp. nov.

PLATE 27.

Stems very slender, glabrous, purplish green; leaflets subequal, narrowly oblong to oblanceolate, 6 to 8 cm. long, 15 to 25 mm. wide, abruptly acute or acuminate, oblique and rounded to subcordate at the base, thin, glabrous, bright green, slightly paler beneath; petiolules 4 to 8 mm. long; peduncles solitary, pendulous, slender, 15 to 21 cm. long; calyx lobes united only at the base, glabrous, green, linear-lanceolate, 25 to 35 mm. long, long-attenuate; corolla deep brownish purple, the tube campanulate, 18 to 20 mm. long, with acute sinuses, puberulent outside, glabrous within, the lobes 6 cm. long, 5 or 6 mm. wide at the base, tapering to the long-attenuate tips; filaments very slender, purple, 9 to 11 cm. long, much exceeding the corolla, villous at the base; anthers purple, 1 cm. long; style slender, 10 to 13 cm. long, glabrous; stigmas slender, 8 mm. long; immature capsule elliptic, acute, glabrous.

Type in the U. S. National Herbarium, no. 677661, collected in sunny but cool places, between the Río Ladrillo and Los Sigüas Camp, southern slope of Cerro de la Horqueta, Chiriquí, Panama, altitude 1,200 to 1,700 meters, March 18, 1911, by H. Pittier (no. 3270).

From the other species with much elongated and very narrow corolla lobes, this may be distinguished by the deep purple corolla with long-attenuate lobes. It is most closely related to *Cobaea penduliflora*, but differs in the narrower, long-attenuate, glabrous calyx lobes, acute sinuses of the corolla, and differently shaped leaflets.

EXPLANATION OF PLATE 27.—Part of type specimen. Scale  $\frac{1}{2}$ .

### 4. *Cobaea gracilis* (Örst.) Hemsl. *The Garden* 17:352. 1880.

PLATE 28.

*Rosenbergia gracilis* Örst. Vid. Medd. Naturh. For. Kjöbenhavn 1856:31. 1856.

TYPE LOCALITY: Naranjo, Costa Rica. Type collected by Örsted.

RANGE: Costa Rica and Panama.

ILLUSTRATIONS: Örst. Amér. Centr. pl. 15. 1863.

<sup>1</sup>The Garden 17: 353. 1880.





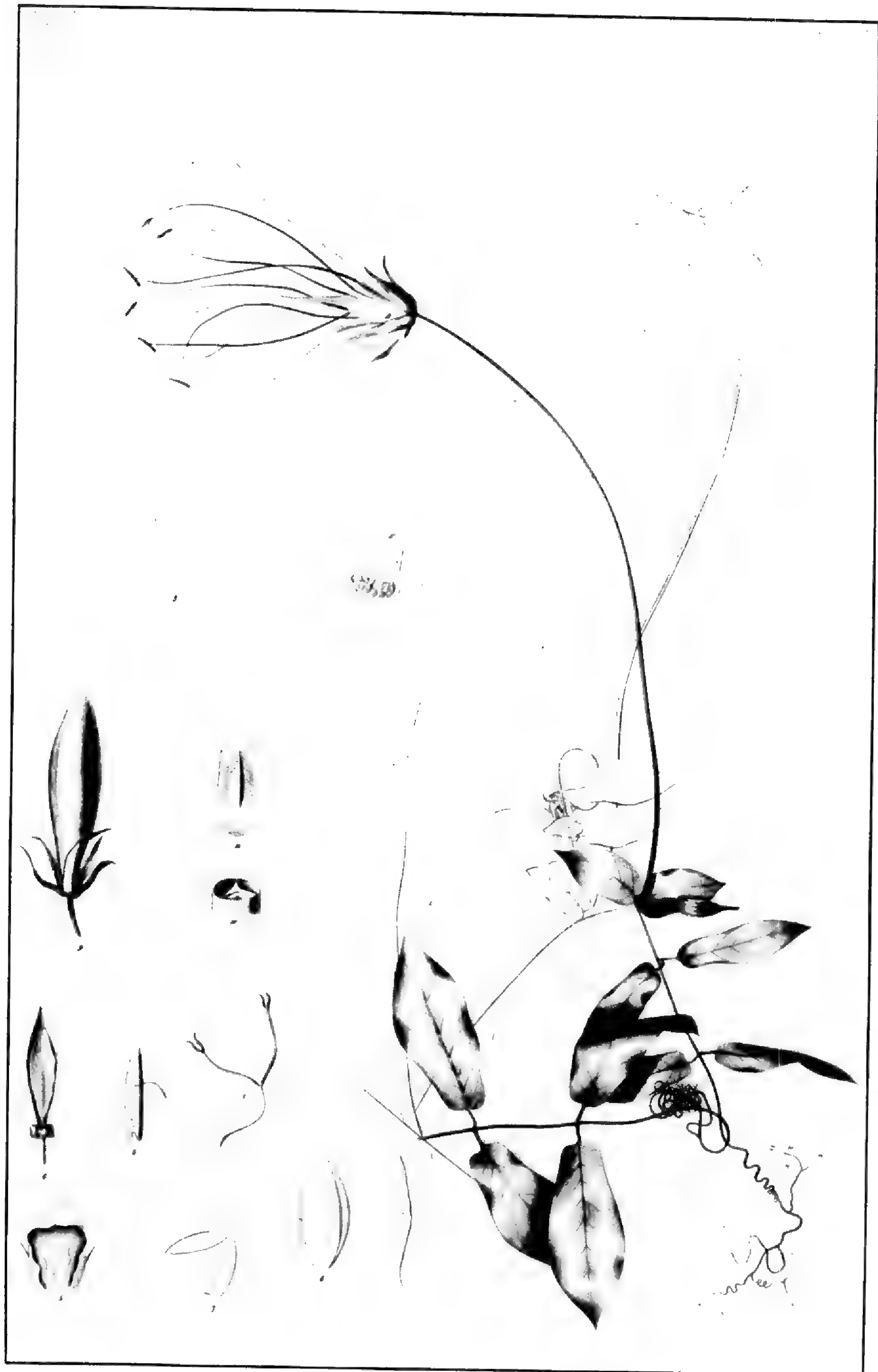
COBAEA HOOKERIANA STANDLEY.





COBAEA PANAMENSIS STANDLEY.





COBAEA GRACILIS (ÖRST.) HEMSLEY.



The writer has seen no specimens of this species. Brand refers here a specimen collected by Polakowsky (no. 395) between Augusta and Zapoto, Province of Cartago, Costa Rica, and one collected by Warscewicz (no. 2, in part) in the province of Veraguas, Panama.

The calyx lobes are figured by Örsted as villous-ciliate, at least in part of the flowers illustrated, but this character is not mentioned in any of the descriptions.

EXPLANATION OF PLATE 28.—Photograph of plate 15 of L'Amérique Centrale, by A. S. Örsted. Scale  $\frac{1}{2}$ .

5. *Cobaea aschersoniana* Brand, *Helios* 21: 87. f. 2. 1904.

*Rosenbergia aschersoniana* House, *Muhlenbergia* 4: 25. 1908.

TYPE LOCALITY: Forests of La Esmeralda, Volcán de Barba, Costa Rica. Type collected by Biolley (Pittier & Durand, no. 7178).

RANGE: Costa Rica.

ILLUSTRATIONS: Brand in *Engl. Pflanzenreich* 27: f. 7A.

SPECIMENS EXAMINED:

COSTA RICA: Bordes du Rio Pedregoso au Copey, alt. 1,800 meters, *Tonduz* (Inst. Fís. Geogr. Costa Rica, no. 12217). Forêts de la Esmeralda, Volcán de Barba, alt. 2,000 meters, *Biolley* (Inst. Fís. Geogr. Costa Rica, no. 7178). Bord des ruisseaux près de chalêts de Turrialba, alt. 2,500 meters, *Pittier* (Inst. Fís. Geogr. Costa Rica, no. 867).

Well distinguished by the densely villous calyx lobes and by the form of the corolla. Brand<sup>1</sup> made this the type of a new section of *Cobaea*, which he called "Aschersoniophila."

The fruit had not been seen by Brand. It may be described as follows: Capsule elliptic in outline, 5 cm. long, 2 cm. in diameter, acute, glabrous, glaucous; seeds 3 in each cell, 20 to 25 mm. long, 11 mm. wide, with very broad thin entire wings.

Brand<sup>2</sup> refers here a specimen collected by Warscewicz (no. 2, in part), no locality being stated. Since the remainder of this number came from Veraguas, Panama, it is probable that *Cobaea aschersoniana* also should be credited to Panama.

6. *Cobaea viorna* Standley, sp. nov.

Stems slender, glabrous, or sparingly puberulent about the nodes; petioles glabrous; leaflets thin, bright green, glabrous, similar and subequal, oval to oblong, 25 to 50 mm. long, 10 to 18 mm. wide, acute, mucronate, unequal and rounded or subcordate at the base, on petiolules 4 to 11 mm. long; peduncles solitary, 15 to 24 cm. long, much exceeding the leaves; calyx segments united only at the base, linear-oblong, 23 to 30 mm. long, 4 to 5.5 mm. wide, acute to abruptly acuminate, glabrous; corolla greenish yellow, 3.5 to 4 cm. long, the tube campanulate, sparingly puberulent outside, the lobes slightly shorter than the tube, ovate-triangular, acuminate, erect; filaments 35 to 55 mm. long, slender, villous at the base; anthers yellow, 1 cm. long; capsule oval in outline, 42 mm. long, 20 mm. wide, acute, glabrous, the cells each with 2 seeds.

Type in the U. S. National Herbarium, no. 256732, collected between Rodeo and Malacate, Guatemala, altitude 420 to 1,050 meters, January 20, 1895, by E. W. Nelson (no. 3745).

Most closely related to *Cobaea lutea*, but with smaller flowers, a greenish corolla, elongated peduncles, and longer calyx lobes. In general appearance the plant suggests some species of *Viorna*, this resemblance being due to the form of the buds, the appearance of the leaves, and the long peduncles.

<sup>1</sup> *Helios* 21: 88. 1904.

<sup>2</sup> In *Engl. Pflanzenreich* 27: 28. 1907.



7. *Cobaea villosa* Standley, sp. nov.

Stems rather stout, striate or subangulate, densely villous about the nodes and sparingly so elsewhere; petioles and tendrils villous to puberulent; leaflets subequal, similar, obovate to oblong-obovate or oblong, 40 to 65 mm. long, 16 to 40 mm. wide, obtuse, mucronate, unequal and rounded or truncate at the base, thin, glaucescent, usually glabrous on the upper surface, sparingly puberulent beneath or glabrate, on petiolules 4 to 12 mm. long; peduncles solitary or 2 together, 13 to 19 cm. long, slender or stout, frequently flattened and usually coiled in age, puberulent or glabrous; calyx lobes united only at the base, 18 to 28 mm. long, 3 to 8 mm. wide, linear-oblong to lance-oblong, rather abruptly acuminate, conspicuously nerved, villous-ciliate; corolla yellowish green, 4 cm. long or slightly less, the tube campanulate, glabrous, the lobes about as long as the tube, ovate-triangular, acuminate, densely short-villous outside, glabrous within; filaments 8 cm. long or less, slender, villous at the base, the anthers yellow, 1 cm. long; capsule elliptic-oval, 4 cm. long, acute, glabrous, the cells 3 or 4-seeded; seeds irregularly oval or oblong, 18 to 21 mm. long, the wings very broad, finely reticulate-veined.

Type in the U. S. National Herbarium, no. 575607, collected in Salvador by Carlos Renson (no. 213).

ADDITIONAL SPECIMENS EXAMINED:

SALVADOR: San Salvador, *Velasco* (J. D. Smith, no. 8882).

From *Cobaea lutea* the present species differs in about the same respects as does *C. viorna*, besides having villous-ciliate instead of usually glabrous calyx lobes. From the latter species it differs in its villous stems, broader, obtuse, glaucescent leaflets, and villous-ciliate calyx segments.

8. *Cobaea lutea* Don, Edinburg Phil. Journ. 10: 112. 1824.

*Cobaea macrostema* Pav.; Don, loc. cit., as synonym; Hook. Curtis's Bot. Mag. 66: pl. 3780. 1840.

*Cobaea acuminata* DC.; Hook. loc. cit.

*Cobaea macrostoma* DC. Prodr. 9: 322. 1845.

*Rosenbergia macrostoma* House, Muhlenbergia 4: 24. 1908.

TYPE LOCALITY: Originally given as "Ad Portum Guayaquil in Regno Quitensi Peruvianorum," but Hooker states<sup>1</sup> that this locality was probably incorrect and that the type came perhaps from Mexico. If, however, the plant that has usually been given this name is correctly determined, the type probably came from Guatemala.

RANGE: Guatemala. Brand<sup>2</sup> also reports a specimen from Salvador, and credits the species to Costa Rica. It may have this range, but possibly these reports are the result of incorrect identifications.

SPECIMENS EXAMINED:

GUATEMALA: Laguna de Ayarza, Department of Jalapa, alt. 2,400 meters, *Heyde & Lux* (J. D. Smith, no. 3987). San Lucas, Department of Antigua, *C. & E. Seler* 2452. Between Guatemala City and Chiquimula, August 18, 1860, *Hayes*. Without locality, *Heyde* 240.

Well distinguished from the related species by the large corolla. The specimen figured by Hooker in the Botanical Magazine was grown at Kew from seeds sent from Guatemala by Skinner.

It is impossible to justify the use of the name *macrostema* (or any of its variations) for this species. Don plainly publishes the plant as *lutea*, citing Pavon's manuscript name *macrostema* as a synonym. Yet *lutea* has never been used by any other author to designate this species.

<sup>1</sup> Loc. cit.

<sup>2</sup> In Engl. Pflanzenreich 27: 28. 1907.



**9. *Cobaea triflora* Donn. Smith, Bot. Gaz. 13: 75. 1888.***Cobaea macrostoma triflora* Brand in Engl. Pflanzenreich 27: 26. 1907.*Rosenbergia triflora* House, Muhlenbergia 4: 25. 1908.

TYPE LOCALITY: Banks of the Rio Cajabón, near Cobán, Department of Alta Verapaz, Guatemala, at an altitude of 1,290 meters. Type collected by H. von Türckheim (no. 204).

RANGE: Known only from type collection.

SPECIMENS EXAMINED:

GUATEMALA: Type specimen.

The fruit, which has not been described, may be characterized as follows: Capsule elliptic or elliptic-oval in outline, about 43 mm. long and 18 mm. broad, acute, glabrous; seeds 2 or 3 in each cell, oval, 20 to 22 mm. long, 10 to 12 mm. wide, acute at the apex, deeply retuse at the base, the wings very broad, entire.

The transference of this species to rank as a subspecies of *Cobaea macrostoma* was unfortunate, since the two are not closely related. This is at once apparent upon comparing the original descriptions. Indeed, they are as distinct from each other as any other two species of the genus. The corolla lobes of *Cobaea triflora* are broadly rounded, while those of *C. lutea* (*macrostoma*) are acuminate. In the latter the stamens are long exserted, while in *C. triflora* they only slightly exceed the corolla. The only differences which Brand indicated between the two plants were the slightly different outline of the leaflets and the ternate rather than solitary arrangement of the peduncles of *triflora*. The flowers of this species seem to be more often solitary than in threes in the specimens seen by the writer, while in *Cobaea lutea* the peduncles are not always solitary.

Brand's error with regard to *Cobaea triflora* can be better understood after noting the specimens he cites under *Cobaea macrostoma triflora*. Three are enumerated. The first, collected in Guatemala by C. and E. Seler (no. 2293), the writer has not seen. The second is the type collection of *Cobaea triflora*. The third is Heyde and Lux's no. 3987, which is here referred to *Cobaea lutea*.

House,<sup>1</sup> in his treatment of *Rosenbergia*, refers to Brand's confusion of *Cobaea macrostoma* and *C. triflora*; but he himself does not clarify matters, for the only specimen which he cites under *triflora* is very different from Captain Smith's type and is evidently of the species here called *C. lutea*.

**10. *Cobaea campanulata* Hemsl. The Garden 17: 352. 1880.***Rosenbergia campanulata* House, Muhlenbergia 4: 24. 1908.

TYPE LOCALITY: Atacama, Chile. Type collected by Hinds.

RANGE: Known only from the type collection.

Hemsley describes the calyx segments as hirsute. The pubescence of the calyx in other species is villous and composed of jointed hairs. Probably it is not essentially different in the South American plant.

**11. *Cobaea minor* Mart. & Gal. Bull. Acad. Sci. Brux. 12: 276. 1845.***Rosenbergia minor* House, Muhlenbergia 4: 24. 1908.

TYPE LOCALITY: Mountain of Orizaba, Mexico, at 3,000 meters. Type collected by Galeotti (no. 1447).

RANGE: Southern Mexico to Costa Rica.

SPECIMENS EXAMINED:

MEXICO: Pié d' Orizaba, Vera Cruz, Galeotti 1447.

COSTA RICA: Volcán de Turrialba, Province of Cartago, alt. 2,400 meters, Pittier (Inst Fís. Geogr. Costa Rica, no. 13075; J. D. Smith, no. 7539).

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<sup>1</sup> Muhlenbergia 4: 22. 1908.



As suggested by Hemsley, the foliage of this species somewhat resembles that of some of the vetches. The leaflets are much smaller than those of any other species. They are dark or dull green and glabrous above, but much paler and loosely villous beneath. The pubescence was not mentioned by Martens and Galeotti, and Brand describes the stems as glabrous. Our specimens, which are of the same and only collections cited by Brand, have numerous loose villous hairs on the stems, especially about the nodes, the pubescence being still more abundant on the petioles. The corolla is violet, according to Galeotti's label, although this was not mentioned in the original description. Brand describes the stamens as "longiuscule exserta," but in all the flowers examined by the writer they are well included. Martens and Galeotti state that the stigma is exserted, but they make no such statement concerning the stamens.

**12. *Cobaea trianaei* Hemsl. The Garden 17: 353. 1880.**

*Rosenbergia trianaei* House, *Muhlenbergia* 4: 24. 1908.

TYPE LOCALITY: Colombia. Brand cites a specimen collected in the Province of Bogotá at 2,300 meters by Triana (no. 2180). This may be the type collection, although Hemsley says the plant was collected in New Granada "without any special locality."

RANGE: Colombia.

ILLUSTRATIONS: Brand in Engl. *Pflanzenreich* 27: f. 7 B.

The writer has seen no specimens of this. Hemsley states that it was collected at Ibaque on the Quindiu by Purdie, at Antioquia by Jervise, and at Tolima de Nevado by Goudot.

**13. *Cobaea pachysepala* Standley, sp. nov.**

PLATE 29.

Stems stout, angulate or striate, glabrous except about the nodes, there sparsely villous; petioles glabrous or sparsely short-villous; leaflets equal, similar, 60 to 85 mm. long, 23 to 27 mm. wide, narrowly oblong, tapering from about two-thirds the distance above the base to an acuminate mucronate apex, rounded to subcordate at the base, dull green, slightly paler beneath, glabrous, or sparsely villous-ciliate when young; peduncles solitary, stout, straight in anthesis but curved or coiled in fruit, 12 to 18 cm. long; sepals united only at the base, lanceolate, 20 to 24 mm. long, rather abruptly attenuate, thick and leathery, puberulent outside near the base, finely tomentulose inside along the margins; corolla yellow, 5.5 to 6 cm. long, narrowed rather abruptly near the base, 4 to 4.5 cm. wide in the throat, finely and sparsely villous outside, the lobes short, 15 to 20 mm. long, rounded-ovate, obtuse, apparently erect; stamens about equaling the corolla, the filaments stout, villous near the apex, the anthers about 6 mm. long; style about 12 mm. longer than the corolla, the stigmas stout, 2.5 mm. long; capsule oblong-oval, 57 mm. long, 21 mm. broad, obtuse, glabrous; seeds numerous (about 8 or 9) in each cell, oblong-oval, about 2 cm. long, obtuse or rounded at the apex, subcordate at the base, broadly winged.

Type in the U. S. National Herbarium, no. 399435, collected on the Volcán de Agua, Department of Sacatepequez, Guatemala, February 15, 1905, by W. A. Kellerman (no. 4395).

ADDITIONAL SPECIMENS EXAMINED:

GUATEMALA: Volcán de Agua, alt. 2,700 to 3,000 meters, *Maxon & Hay* 3747.

It is difficult to tell with which of the previously described species this should be compared, for it is not very closely related to any of them. Perhaps it is nearest *Cobaea triflora*, but it differs widely in the size and form of the leaflets, as well as in the numerous seeds. The leaflets are different from those of any





COBAEA PACHYSEPALA STANDLEY.





COBAEA BIAURITA STANDLEY.



other species except *C. tomentulosa*, being of nearly uniform width for two-thirds their length, then tapering to the apex.

EXPLANATION OF PLATE 29.—Specimen of *Cobaea pachysepala*, Mazon & Hay 3747. Scale  $\frac{1}{2}$ .

14. *Cobaea tomentulosa* Standley, sp. nov.

Stems stout, obscurely tomentulose except about the nodes, there tomentose; petioles stout, abundantly tomentulose; leaflets narrowly oblong to lance-oblong or elliptic, 5 to 9 cm. long, 25 to 30 mm. wide, acute, mucronate, rounded or subcordate at the base, dull green, sparsely puberulent on the upper surface, loosely villous beneath with rather short hairs, on petiolules 7 to 14 mm. long; peduncles stout, solitary, 22 to 24 cm. long, at first straight and erect, curved or coiled in age, sparsely puberulent; calyx segments united only at the base, 20 to 25 mm. long, lanceolate to narrowly oblong, acuminate, thick, densely tomentulose outside and along the margins within; corolla 55 to 60 mm. long, truncately obconic, villous outside, glabrous within, yellow, the lobes about half as long as the tube, rounded-ovate, obtuse; stamens only slightly surpassing the corolla, the filaments villous, densely so at the base, the anthers yellow, 8 mm. long; style slightly exserted, the stigmas thick, 3 mm. long; capsule oblong-elliptic, 55 mm. long, acutish, glabrous; seeds 4 to 6 in each cell, about 2 cm. long.

Type in the U. S. National Herbarium, no. 250869, collected near Zunil, Guatemala, altitude 2,340 to 2,400 meters, January 20, 1896, by E. W. Nelson (no. 3683).

Similar in general form to the preceding species, but distinguished by the densely tomentulose calyx and the villous leaflets of slightly different outline on longer petiolules.

15. *Cobaea biaurita* Standley, sp. nov.

PLATE 30.

Stems slender, glabrous; leaflets glabrous, green, slightly paler beneath, rather abruptly acute or acuminate, mucronate, the lowest pair sessile, elliptic or narrowly oval, constricted above the base, with 2 rounded unequal basal auricles, the upper leaflets oval, unequal and rounded to acutish at the base, on petiolules 5 to 7 mm. long; peduncles stout, solitary, about 20 cm. long; calyx lobes united for only a short distance at the base, broadly oblong-ovate, about 3 cm. long, 13 to 15 mm. wide, rather abruptly narrowed to a triangular-subulate tip, green, glabrous outside, densely puberulent within; corolla 6 cm. long, 2.5 cm. wide above the base, sparsely villous-puberulent outside, the lobes less than half as long as the tube, broadly rounded; stamens slightly exserted, the anthers about 8 mm. long; style exserted about 2 cm., the stigmas stout, 2 mm. long; fruit not seen.

Type in the U. S. National Herbarium, no. 233329, collected near Tumbala, Chiapas, Mexico, altitude 1,200 to 1,650 meters, October 20, 1895, by E. W. Nelson (no. 3363).

Nearest *Cobaea scandens*, but distinguished by the green foliage, differently shaped leaflets, and very different calyx lobes, which are united for only a short distance at the base. In *C. scandens* the calyx segments are broadly rounded at the apex and mucronate. The plant is said to be a vine 4.5 to 6 meters high, with greenish flowers.

EXPLANATION OF PLATE 30.—Type specimen. Scale  $\frac{1}{2}$ .

16. *Cobaea pringlei* (House) Standley.

PLATE 31.

*Rosenbergia pringlei* House, Muhlenbergia 4: 24. 1908.

TYPE LOCALITY: In the Sierra Madre near Monterey, State of Nuevo Leon, Mexico. Type collected by Pringle (no. 11901), August 29, 1903.

RANGE: Known only from type collection.



## SPECIMENS EXAMINED:

MEXICO: Type collection.

This comes from a locality far north of those reported for other members of the genus. It is related to the last preceding species; but the corolla is larger, the calyx lobes of very different form, and the leaflets obtuse (rather than acute or acuminate) and glaucescent.

EXPLANATION OF PLATE 31.—Specimen of type collection in the U. S. National Herbarium. Scale  $\frac{1}{2}$ .

17. *Cobaea stipularis* Benth. Pl. Hartw. 45. 1840.

*Rosenbergia stipularis* House, *Muhlenbergia* 4: 23. 1908.

TYPE LOCALITY: Near San Cornello, State of Hidalgo, Mexico. Type collected by Hartweg (no. 344).

RANGE: Southern Mexico.

ILLUSTRATIONS: Edwards's Bot. Reg. 27: pl. 25.

The only specimen the writer has seen is one in the U. S. National Herbarium, grown in the Royal Botanical Garden at St. Petersburg. This has no open flowers, but the form of the leaves is exactly that described and figured for *Cobaea stipularis*. The species is readily distinguished by having the lowest pair of leaflets reduced and stipule-like. Brand<sup>1</sup> reports a specimen from Guayaquil, but it is very doubtful whether it is correctly determined. Hemsley<sup>2</sup> refers here Coulter's 928 from Zimapan, Mexico, while House cites Mueller's no. 634 from Orizaba.

18. *Cobaea scandens* Cav. Icon. Pl. 1: 11. pl. 16, 17. 1791.

*Rosenbergia scandens* House, *Muhlenbergia* 4: 23. 1908.

TYPE LOCALITY: Described from plants cultivated at Madrid, grown from seeds said to have come from near the City of Mexico.

RANGE: Southern Mexico.

ILLUSTRATIONS: Curtis's Bot. Mag. 21: pl. 851; Fl. Serr. Jard. 14: pl. 1467; Engl. & Prantl, Pflanzenfam. 4<sup>ta</sup>: f. 19; Lubbock, Contr. Knowl. Seedl. 2: f. 529; Engl. Pflanzenreich 27: f. 6.

## SPECIMENS EXAMINED:

MEXICO: Orizaba, *Botteri* 294. Environs de Puebla, October 10, 1909, *Nicolas*.

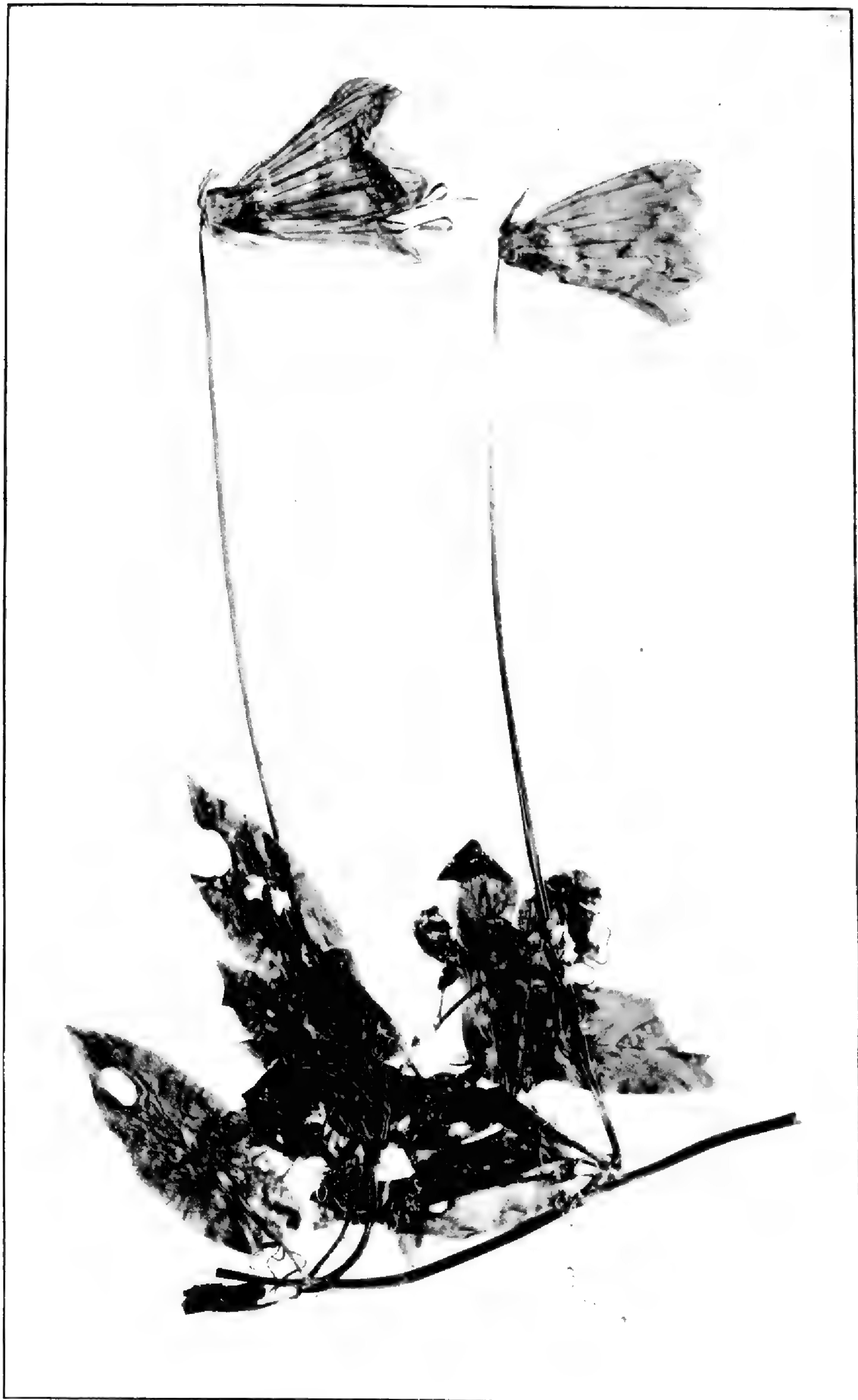
The plant is not uncommon in cultivation, having been introduced into Europe as early as 1787. Most of the seedsmen of the United States offer the seeds. A form with variegated leaves is known, this being the one illustrated in the *Flore des Serres*.

This species is readily distinguished from all the others by the very broad, rounded calyx lobes which are united nearly to the middle. According to Brand<sup>1</sup> it has escaped from cultivation in Brazil.

<sup>1</sup> In Engl. Pflanzenreich 27: 26. 1907.

<sup>2</sup> The Garden 17: 352. 1880.





COBAEA PRINGLEI (HOUSE) STANDLEY.



# TROPICAL NORTH AMERICAN SPECIES OF PANICUM.

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By A. S. HITCHCOCK and AGNES CHASE.

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## INTRODUCTION.

In a preceding paper<sup>1</sup> our knowledge of the North American species of *Panicum* was presented in a revision of the genus, based upon material in the United States National Herbarium. Since the publication of that paper a large amount of additional material from tropical North America has been accumulated. Mr. Hitchcock visited Mexico in 1910, Central America and Panama in 1911, and Jamaica and Trinidad in 1912. Mrs. Chase visited Sonora in 1910 and Porto Rico in 1913. The collections of Mr. H. Pittier in Panama, of Brother León of the Colegio de la Salle, Habana, in Cuba, and of several other collectors in tropical North America, besides specimens from various islands of the West Indies received through Dr. I. Urban, serve to augment the amount of material studied. As a result of these further studies in the genus the range of nearly all the tropical species described in the revision can be presented in much greater detail. Several South American species hitherto unknown from North America and several new species have been discovered, while a few doubtful species and a few referred to synonymy have by field work and further study been established as valid.

While the present paper is supplementary to the revision, it is designed to be of use for the region covered without necessarily referring to the main work. For this reason keys are given for all the tropical species, though descriptions are given of additional species only. A study in their native habitat of species before known from herbarium specimens alone, has necessitated in some cases a revision of the description of habit or of duration, or exceptions have been found to characters given as common for groups. Such notes are given without other description and are to be understood as additions to or corrections of the descriptions given in the revision. Following the reference to the original publication of each species is a reference

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<sup>1</sup> Contr. U. S. Nat. Herb. 15. 1910.



to the description in the revision, if the species is there described. No synonymy is given except such as is additional to that cited in the previous work.

The distribution here given is based upon all the material at present in the National Herbarium, including that already cited. As in the earlier paper all specimens cited are in the United States National Herbarium, unless otherwise stated. Specimens from other herbaria are cited when such specimens add to the known range. Through the courtesy of Dr. I. Urban the grasses of the Krug and Urban Herbarium in the Berlin Museum were submitted for study. Many additional specimens are cited from this herbarium, such specimens being indicated by the abbreviation "K. U. Herb." The range within the region covered is graphically presented by maps. For the sake of comparison these maps indicate also the distribution in the southern border of the United States of such species as extend into this region. Trinidad and Tobago, though they are continental islands and their flora is essentially South American, are included in the West Indies because they are so included by Grisebach<sup>1</sup> and by Urban.<sup>2</sup> In order to connect Panama and Trinidad the detailed distribution includes Venezuela and Colombia.

### KEY TO SPECIES AND GROUPS.

Axis of branchlets produced beyond the base of the uppermost spikelet as a point or bristle 1 to 6 mm. long..... Subgenus *PAUROCHAETIUM*, p. 463.

Axis of branchlets not produced into a bristle. (In *P. geminatum* and *P. paludivagum* the somewhat flattened axis pointed but not bristle-form.)

Basal leaves usually distinctly different from those of the culm, forming a winter rosette; culms at first simple, the spikelets of the primary panicle not perfecting seed, later usually becoming much branched, the small secondary panicles with cleistogamous, fruitful spikelets.

Subgenus *DICHANTHELIUM*, p. 512.

Basal leaves similar to culm leaves, not forming a winter rosette; spikelets all fertile.

Plants annual.

Spikelets plano-gibbous, the second glume swollen, bristly and burlike at maturity; first glume nearly as long as the minute spikelet.

116. *P. hirtum*.

Spikelets not plano-gibbous nor burlike.

Panicles consisting of several more or less secund spikelike racemes; fruit transversely rugose; glumes and sterile lemma usually reticulate-veined..... See *FASCICULATA*, p. 467.

Panicles more or less diffuse (small and narrow in *P. vaseyanum*).

Blades ovate-lanceolate or elliptical, one-fifth to one-fourth as broad as long; plants low; spikelets minute, not over 1.5 mm. long.

Spikelets pyriform, attenuate at base, glabrous.

71. *P. pyricularium*.

Spikelets elliptic, pubescent..... 67. *P. trichoides*.

<sup>1</sup> Fl. Brit. W. Ind.

<sup>2</sup> Symb. Ant.



Blades linear, many times as long as broad; spikelets 1.7 mm. or more long.

First glume not over one-fourth the length of the spikelet, truncate or triangular-tipped.

See DICHOTOMIFLORA, p. 473.

First glume usually as much as half the length of the spikelet, acute or acuminate..... See CAPILLARIA, p. 476.

Plants perennial.

Spikelets short-pedicel along one side of the panicle branches, forming more or less spikelike racemes.

First glume nearly as long as the obtuse spikelets; plants with long wiry stolons with woolly nodes..... 111. *P. obtusum*.

First glume much shorter than the spikelet.

Spikelets more or less hispid.

Sterile lemma glandless; second glume inflated-gibbous.

73. *P. ineptum*.

Sterile lemma bearing a pair of crateriform glands.

See STOLONIFERA, p. 500.

Spikelets glabrous.

Blades lanceolate or ovate-lanceolate; glumes strongly carinate.

See STOLONIFERA, p. 500.

Blades linear, often elongated; glumes not carinate or but slightly so.

Fruit transversely rugose..... See GEMINATA, p. 465.

Fruit not rugose.

Second glume shorter than the spikelet; fertile lemma subindurate, inrolled only at base, scabrous at the acute apex.

112. *P. stagnatile*.

Second glume as long as the spikelet; fertile lemma indurate, inrolled to the summit..... See LAXA, p. 492.

Spikelets in open or sometimes in contracted or congested panicles, but not in 1-sided spikelike racemes.

Fruit transversely rugose..... See MAXIMA, p. 483.

Fruit not transversely rugose (minutely papillose-roughened in *P. millegrana*).

Culms more or less succulent; plants glabrous or nearly so throughout, aquatic or subaquatic.

First glume not over one-fifth the length of the spikelet.

See DICHOTOMIFLORA, p. 473.

First glume one-third to half the length of the spikelet.

Fruit indurate, the margins of the lemma inrolled; culms erect; panicle contracted..... 48. *P. condensum*.

Fruit subindurate, the margins of the lemma inrolled only at base; culms decumbent at base; panicles open.

Spikelets 1.8 mm. long; second glume shorter than the fruit; secondary panicle branches secund..... 112. *P. stagnatile*.

Spikelets 2.5 mm. long; second glume exceeding the fruit; panicle branches not secund..... 113. *P. grande*.

Culms not succulent.

First glume hyaline, inconspicuous; spikelets acuminate; lower blades with long petiole-like bases..... 114. *P. tuerckheimii*.

First glume evident.

First glume very small, not over one-fourth the length of the small obovate, blunt, glabrous spikelets.

See PARVIGLUMIA, p. 502.



First glume usually more than one-third the length of the spikelet, if shorter the spikelets not small and blunt.

Sterile palea enlarged and indurate at maturity, expanding the spikelet; blades scarcely wider than their sheaths.

See LAXA, p. 492.

Sterile palea if present not enlarged and indurate.

First glume short, blunt; spikelets pointed; base of culm usually decumbent and rooting.

See DICHOTOMIFLORA, p. 473.

First glume usually more than one-third the length of the spikelet.

Plants forming conspicuous hard creeping scaly rootstocks.

See VIRGATA, p. 486.

Plants not forming creeping scaly rootstocks.

Fruit crested at the apex; spikelets 5.5 to 6 mm. long.

115. *P. zizanioides*.

Fruit not crested.

Panicles narrow and few-flowered; culms erect and wiry; blades drying involute. . . See TENERA, p. 490.

Panicles open or contracted, many-flowered.

Panicles 40 to 60 cm. long, the numerous elongated branches in verticils. . . . . 77. *P. megiston*.

Panicles mostly much less than 40 cm. long; branches not verticillate.

Spikelets short-pediceled along the nearly simple panicle branches. . . . . 48. *P. condensum*.

Spikelets long-pediceled; panicle open at maturity.

Primary panicles open, the secondary reduced, narrow, partly inclosed in the sheaths.

First glume three-fourths as long as the elliptical spikelets; fruit apiculate.

See CORDOVENSIA, p. 525.

First glume one-third as long as the pyriform spikelets; fruit not apiculate.

104. *P. nodatum*.

Primary and secondary panicles alike, or the secondary wanting.

First glume not pointed, two-thirds the length of the spikelet or more; spikelets blunt.

Panicles not over 6 cm. long; plants somewhat glaucous, relatively small.

See PARVIFOLIA, p. 506.

Panicles 10 to 20 cm. long, very diffuse; plants tall, not glaucous.

Spikelets viscid, 3 mm. long.

75. *P. glutinosum*.

Spikelets not viscid, 2 to 2.3 mm. long.

74. *P. millegrana*.

First glume pointed, usually less than two-thirds as long as the pointed spikelets.

Spikelets more or less pubescent.

Culms slender, straggling; spikelets not turgid; glumes and sterile lemma hirsute along the margins.

72. *P. haenkeanum*.



Culms stout, erect or nearly so; spikelets  
turgid, sparsely hirsute.

76. *P. rudgei*.

Spikelets glabrous.

Culms straggling; spikelets minute.

68. *P. trichanthum*.

Culms erect or stiffly ascending; blades  
linear, usually elongated.

Sheaths glabrous; culms 1.5 to 2 meters  
high..... 40. *P. ichnanthoides*.

Sheaths hirsute, or if glabrous the culms  
less than 1 meter high.

See DIFFUSA, p. 480.

ANNOTATED LIST OF THE SPECIES.

Subgenus PAUROCHAETIUM Hitchc. & Chase.

Blades less than 10 cm. long, not narrowed toward the base;  
spikelets about 2.5 mm. long..... 4. *P. ramisetum*.

Blades elongated, usually more than 15 cm. long, narrowed  
toward the base.

First glume rounded or truncate; second glume about as  
long as fruit..... 3. *P. chapmani*.

First glume acute; second glume about two-thirds as long as  
fruit.

Spikelets 1.5 mm. long; blades involute..... 1. *P. distantiflorum*.

Spikelets 2 mm. long; blades flat..... 2. *P. utowanaeum*.

1. *Panicum distantiflorum* A. Rich.

*Panicum distantiflorum* A. Rich. in Sagra, Hist. Cuba 11: 304. 1850; Contr. U. S.  
Nat. Herb. 15: 23. 1910.

DISTRIBUTION.

Limestone hills at low altitudes, Bahamas to Cuba and Haiti; Curaçao. The type  
specimen from Cuba.

BAHAMAS: Inagua, Hitchcock in  
1890, Nash & Taylor 893 (both  
Field Mus. Herb.).

CUBA: Playa de Cojimar, Hitchcock  
144, León 912. Near Habana,  
León 305 b, 567, 2382. Santiago,  
León 917. Silla de Cayo, Shafer  
2512. Guanoroca, Wright 284.  
Hanábana, Wright 285. Playa  
de Marianao, León in 1909.  
Without locality, Wright 3452.

SANTO DOMINGO: Naranjo, Fuertes 1284. Los Charcos, Fuertes 1427.

CURAÇAO: Britton & Shafer 3088. Bonaire, Suringar in 1885. (K. U. Herb.)<sup>1</sup>



FIG. 11.—Distribution of *P. distantiflorum*.

<sup>1</sup> Krug & Urban Herbarium.



## 2. *Panicum utowanaeum* Scribn.

*Panicum utowanaeum* Scribn. in Millsp. Field Mus. Bot. 2: 25. 1900; Contr. U. S. Nat. Herb. 15: 24. 1910.

### DISTRIBUTION.

Open rocky soil, mostly near the coast, Cuba, Porto Rico, Guadeloupe, and Venezuela. The type specimen from Porto Rico.



FIG. 12.—Distribution of *P. utowanaeum*.

CUBA: Tricornia, *Hitchcock* 141, *Tracy* 9089. Cayo Guajaba, *Shafer* 2830. Playa Marianao, *Wilson* 9497. Eastern Cuba, *Wright* 3452.

SANTO DOMINGO: Azua, *Rose, Fitch & Russell* 3891.

PORTO RICO: Guanica, *Millsbaugh* Pl. Utow. 702, *Sintenis* 3365, 3416, 3463, *Chase* 6520. Santa Rita, *Chase* 6535, Laguna Guanica, *Chase* 6533. Mona, *Hess* 431, 455, 457.

LEEWARD ISLANDS: Guadeloupe, *Duss* 3177.

VENEZUELA: Near Puerto Caballo, *Pittier* 6434.

## 3. *Panicum chapmani* Vasey.

*Panicum chapmani* Vasey, Bull. Torrey Club 11: 61. 1884; Contr. U. S. Nat. Herb. 15: 24. 1910.

### DISTRIBUTION.

Coral sand and shell mounds, southern Florida and the Bahamas. The type specimen from Florida.

BAHAMAS: New Providence, *Britton & Brace* 401. Rose Island, *Britton & Millspaugh* 2137. Great Exuma, *Britton & Millspaugh* 3076. (All in Field Mus. Herb.)



FIG. 13.—Distribution of *P. chapmani*.

## 4. *Panicum ramisetum* Scribn.

*Panicum ramisetum* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 27: 9. 1900; Contr. U. S. Nat. Herb. 15: 25. 1910.

### DISTRIBUTION.

Sandy plains and prairies, southern Texas and northern Mexico. The type specimen from Texas.



FIG. 14.—Distribution of *P. ramisetum*.

COAHUILA: Near Díaz,<sup>1</sup> *Pringle* 8323.

<sup>1</sup> The "Guía Postal de la República Mexicana" has been followed in the accenting of Mexican geographical names.



TRUE PANICUM.

GEMINATA.

- Nodes bearded..... 7. *P. barbinode*.  
Nodes glabrous.  
Spikelets 3 mm. long; glumes and sterile lemma papery..... 6. *P. paludivagum*.  
Spikelets not over 2.4 mm. long; glumes and sterile lemma  
not papery..... 5. *P. geminatum*.

5. *Panicum geminatum* Forsk.

*Panicum geminatum* Forsk. Fl. Aegypt. Arab. 18. 1775; Contr. U. S. Nat. Herb. 15: 30. 1910.

This species is described by Presl<sup>1</sup> under the name *Panicum brizoides* L. (as well as under *P. brizaeforme* Presl). The Haenke specimen from Mexico is in the herbarium of the National Museum at Prague.

DISTRIBUTION.

Moist ground, ditches and swamps, mostly near the coast, tropical regions of both hemispheres, in America extending north into southern Florida and Texas. Originally described from Rosetta, Egypt.

- LOWER CALIFORNIA: El Taste, *Brandeggee* in 1893. San José del Cabo, *Brandeggee* 14, 36.  
SONORA: Yaqui River, *Palmer* 15 in 1869. Guaymas, *Palmer* 690 in 1887. Sierra de Alamos, *Rose, Standley & Russell* 12996.  
SINALOA: Mazatlán, *Rose, Standley & Russell* 14109.  
TAMAULIPAS: Tampico, *Hitchcock* 5796, *Palmer* 259 in 1910.  
COLIMA: Manzanillo, *Hitchcock* 7032.  
VERACRUZ: Veracruz, *Hitchcock* 6586.  
GUERRERO: Acapulco, *Palmer* 289 in 1894.  
YUCATÁN: Izamal, *Gaumer* 1027.  
GUATEMALA: San José, *Kellerman* 6250.  
SALVADOR: Lake Ilopango, *Hitchcock* 8920.  
COSTA RICA: Bebedero, *Jiménez* 734.  
PANAMA: Corozal, *Pittier* 2168, 2170. Pedro Miguel, *Hitchcock* 7956, *Pittier* 2509. Empire, *Pittier* 3714. Gatun, *Hitchcock* 7980.  
BAHAMAS: Nassau, *Curtiss* 175. Fortune Island, *Eggers* 3992 (K. U. Herb.).  
CUBA: Habana, *León* 769, 918. Corrientes Bay, *Britton & Cowell* 9931. Santiago de las Vegas, *Hitchcock* 143. Guanabacoa, *León* 920. Guantánamo, *Britton* 2281. Sancti Spiritus, *Sergius* 2789. Batabanó, *Hitchcock* 142. Hanábana, *Wright* 761. Palma Sola, *Wright* in 1860.  
JAMAICA: Gordon Town, *Hart* 806. Ferry River, *Harris* 11352. Appleton, *Hitchcock* 9653. Palisadoes near Kingston, *Hitchcock* 9752. Black River, *Hitchcock* 9579. Savanna-la-Mar, *Hitchcock* 9877.



FIG. 15.—Distribution of *P. geminatum*.

<sup>1</sup> Presl, Rel. Haenk. 1: 302. 1830.



HAITI: La Coupe, *Buch* 975. Port-au-Prince, *Picarda* 1430. (Both in K. U. Herb.)

PORTO RICO: Guanica, *Chase* 6527, 6531, *Sintenis* 3367. Mayaguez, *Chase* 6288, 6318. Boqueron, *Chase* 6511. Coamo Springs, *Chase* 6552.

DANISH WEST INDIES: St. Croix, *Ricksecker* 212. St. Thomas, *Eggers* in 1882.

LEEWARD ISLANDS: Antigua, *Wulfschlaegel* 614. Guadeloupe, *Duss* 2690, 3584, *L'Herminier*.

WINDWARD ISLANDS: Martinique, *Duss* 1293.

TRINIDAD: Icacos, *Hitchcock* 10158.

CURAÇAO: Aruba, *Suringar* in 1885.

VENEZUELA: Paparo, *Pittier* 6347.

COLOMBIA: Santa Marta, *Smith* 151.

#### 6. *Panicum paludivagum* Hitchc. & Chase.

*Panicum paludivagum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 32. 1910.



FIG. 16.—Distribution of *P. paludivagum*.

#### DISTRIBUTION.

Fresh-water lakes and rivers, the base submerged, Florida and Texas, Mexico, Central America to Uruguay. The type specimen from Florida.

JALISCO: Guadalajara, *Palmer* 429 in 1886, *Hitchcock* 7294. Orozco, *Hitchcock* 7374.

MICHOACÁN: Lake Pátzcuaro, *Pringle* 3336. Zamora Valley, *Pringle* 9556. Morelia, *Arsène* in 1909.

GUATEMALA: Amatitlán, *Kellerman* 6253, 6254, *Pittier* 101, *Türkheim* 8790.

#### 7. *Panicum barbinode* Trin.

*Panicum barbinode* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 1: 256. 1834; Contr. U. S. Nat. Herb. 15: 33. 1910.

Commercially known as "Pará grass"; called "malajilla" in Porto Rico.

#### DISTRIBUTION.

Cultivated and waste ground, especially in moist places, tropical America, extending into southern Florida and Texas; introduced in the warmer parts of the Old World. The type specimen from Bahia, Brazil.

LOWER CALIFORNIA: San José del Cabo, *Brandegge* 46. La Paz, *Palmer* 131 in 1890.

CÓLIMA: Paso del Río, *Emrick* 8. Manzanilla, *Palmer* 1078.

MÉXICO: Cuantla, *Holway* 3045.

VERACRUZ: Veracruz, *Amer. Gr. Nat. Herb.* 4.<sup>1</sup>

OAXACA: Tomellín, *Hitchcock* 6227.

YUCATÁN: Mérida, *Collins* 27.

GUATEMALA: Mazatenango, *Maxon & Hay* 3476. Cubilquitz, *Türkheim* 7799, 8617. Escuintla, *Hitchcock* 9007.

SALVADOR: Without locality, *Renson* 214.

NICARAGUA: Jinotepe, *Hitchcock* 8701. Chinandega, *Baker* 2053.

COSTA RICA: Térraba, *Pittier* 412, 4090. Río Tuís, *Tonduz* 11393. Puntarenas, *Hitchcock* 8545. Taboga, Guanacaste, *Jiménez* 722. Turrialba, *Tonduz* 8401.

<sup>1</sup> American Grasses, exsiccatae distributed from the U. S. National Herbarium, Smithsonian Institution.



PANAMÁ: El Boquete, *Hitchcock* 8266. Gatun Lake, *Pittier* 2559, *Hitchcock* 80314. Pedro Miguel, *Hitchcock* 7931. Chepo, *Pittier* 4734. Culebra, *Pittier* 4807.

BAHAMAS: Nassau, *Curtiss* 115.

CUBA: Near Habana, *León* 568. Camaguey, *Shafer* 2881. Romelie, *Eggers* 4870. Cienfuegos, *Pringle* 26. Almendares River, *León* 283. Without locality, *Wright* 1545.

JAMAICA: Hope Gardens, *Harris* 11254, 10930. Mount Hybla, *Harris* 11565. Newcastle, *Hitchcock* 9339. Black River, *Hitchcock* 9580. Montego Bay, *Hitchcock* 9693.

PORTO RICO: Bayamon, *Hioram* 360, *Millspaugh* 324, *Heller* 100. Aibonito, *Goll* 613. Playa de Fajardo, *Chase* 6657. Guanica, *Chase* 6528, *Mills-  
paugh* 727. Yauco, *Heller* 6293. Los Mameyes, *Eggers* 1328. Vieques, *Chase* 6679. Mona, *Hess* 450.

DANISH WEST INDIES: St. Croix, *Ricksecker* 300.

LEEWARD ISLANDS: Guadeloupe, *Duss* 2689, *L'Herminier*. Dominica, *Eggers* 1030 (K. U. Herb.).

WINDWARD ISLANDS: Martinique, *Duss* 539. Grenada, *Buckmire* 1423, *Broad-  
way* in 1904 and in 1905. St. Vincent, *Eggers* 6834 (K. U. Herb.). Barba-  
dos, *Eggers* 7079 (K. U. Herb.).

TRINIDAD: Port of Spain, *Hitchcock* 9941, 10044.

TOBAGO: Scarborough, *Hitchcock* 10204.

CURAÇAO: Santa Cruz, *Britton & Shafer* 3012.

COLOMBIA: Cartagena, *Hitchcock* 9901. Santa Marta, *Smith* 211. Without  
locality, *Lehmann* 5744.



FIG. 17.—Distribution of *P. barbinode*.

FASCICULATA.

- Spikelets 5 to 6 mm. long..... 13. *P. texanum*.
- Spikelets 2 to 4 mm. long.
  - Spikelets strongly reticulate-veined, 2 to 3 mm. long; glabrous.
    - Panicle branches long and spreading; blades pubescent or glabrous..... 9. *P. fasciculatum*.
    - Panicle branches short, appressed; blades narrow, pubescent..... 9a. *P. fasciculatum reticulatum*.
  - Spikelets scarcely reticulate-veined or only near the apex.
    - Spikelets not over 2 mm. long, glabrous..... 8. *P. reptans*.
    - Spikelets over 3 mm. long, pubescent.
      - Rachis scabrous but not bristly ..... 11. *P. adpersum*.
      - Rachis pilose with bristly hairs.
        - Plant more or less velvety; sheaths not papillose. 10. *P. molle*.
        - Plant not velvety; sheaths papillose ..... 12. *P. arizonicum*.

8. *Panicum reptans* L.

*Panicum reptans* L. Syst. Nat. ed. 10. 2: 870. 1759; Contr. U. S. Nat. Herb. 15: 36. 1910

DISTRIBUTION.

Open ground at low altitudes especially near the coast, frequently a weed in waste places and cultivated soil, Gulf Coast of the United States and Atlantic slope of



Mexico through the West Indies to northern South America; also introduced in the warm regions of the Eastern Hemisphere. The type specimen from Jamaica.

TAMAULIPAS: Tampico, *Palmer* 153 in 1910.

VERACRUZ: Baños del Carrizal, *Purpus* 6213.

OAXACA: Tomellín, *Hitchcock* 6231. Cuicatlán, *Nelson* 1622.

CUBA: Habana, *Curtiss* 691, *Hitchcock* 146, *León* 3474. Habana Vedado, *León* 276, 292, 297, 566. Habana Vibora, *León* 906, 910c. El Caño, *León* 1980. Baracoa, *Shafer* 3955, *Palmer*, *Pollard & Palmer* 19. Buenaventura, *Wilson* 9243, 9399. Río Almendares, *Wilson* 9187. Cojimar, *Britton*, *Earle & Gager* 6295. Valley of Bacuranao River, *León & Wilson* 2869. Cienfuegos, *Pringle* 73. Herradura, *Tracy* 9103. San Antonio, *Hitchcock* 145. Madruga, *Curtiss* 536. Arroyo Apolo, *León* 576. La Magdalena, *Earle & Baker* 2455. Santiago de Cuba, *León* 910. Guayabal, *León* 910b. Guantánamo Bay, *Britton* 1933, 2245. Romelie, *Eggers* 5346. Without locality, *Wright* 762, 763, 3857.

JAMAICA: Prospect, *Harris* 11539. Black River, *Hitchcock* 9631. Montego Bay, *Hitchcock* 9689. Hope, *Harris* 6845. Gordon Town, *Hart* 838.



FIG. 18.—Distribution of *P. reptans*.

HARTI: Without locality, *Picarda* 1246 (K. U. Herb.).

SANTO DOMINGO: Rincón, *Fuertes* 1377, 1417. San Pedro de Macoris, *Rose, Fitch & Russell* 4171.

PORTO RICO: Guanica, *Chase* 6515, *Millspaugh* 726, *Sintenis* 3368. Bayamon, *Chase* 6395. Joyuda, *Chase* 6305. Ponce, *Heller* 497,

*Chase* 6326. Cabo Rojo, *Sintenis* 847. Coamo Springs, *Goll* 662. Fajardo, *Chase* 6664. Vieques, *Chase* 6700.

DANISH WEST INDIES: St. Croix, *Ricksecker* 77. St. Thomas, *Eggers* 293.

LEEWARD ISLANDS: Antigua, *Wulfschlaegel* 617. Guadeloupe, *Duss* 3529. St. Martin, *Boldingh* 3383 (K. U. Herb.).

WINDWARD ISLANDS: Martinique, *Duss* 1290. Grenada, *Broadway* 721. Bequia, *Smith & Smith* 19, 370 (K. U. Herb.). Barbados, *Eggers* 7081 (K. U. Herb.). *Bot. Sta. Herb.* 538.

TOBAGO: Scarborough, *Hitchcock* 10212.

CURAÇAO: Santa Cruz, *Britton & Shafer* 2987, 3002.

VENEZUELA: El Valle, Island of Margarita, *Miller & Johnston* 171.

COLOMBIA: Santa Marta, *Smith* 173, 2753. Cartagena, *Hitchcock* 9907. Puerto de Colombia, *Hitchcock* 9936.

#### 9. *Panicum fasciculatum* Swartz.

*Panicum fasciculatum* Swartz, Prodr. Veg. Ind. Occ. 22. 1788; Contr. U. S. Nat. Herb. 15: 38. 1910.

*Panicum chartaginense* Swartz, Prodr. Veg. Ind. Occ. 22. 1788; Contr. U. S. Nat. Herb. 15: 40. 1910. "America meridionalis chartagena." A reconsideration of Swartz's type in the light of recent collections from the region whence it came leads to the conclusion that it is referable to *Panicum fasciculatum* rather than to the narrow-panicked form confined to the semiarid southwestern United States and Mexico, which was described by Torrey as *P. reticulatum*.



## DISTRIBUTION.

Moist open ground, often a weed in fields and waste places, southern Florida and Texas, through Mexico and the West Indies to central South America. The type specimen from Jamaica.

SONORA: Hermosillo, *Hitchcock* 3598. Imeris to Santa Ana, *Griffiths* 6857.

Alamos, *Palmer* 694 in 1890. Guaymas, *Palmer* 158 and 207 in 1887.

CHIHUAHUA: Norogachi, *Palmer* 1a in 1885.

SINALOA: Rosario, *Rose* 1834, 1884. Topolobampo, *Palmer* 241 in 1897. Culiacán, *Palmer* 1557 in 1891.

SAN LUIS POTOSÍ: Rascón, *Purpus* 5418. Cárdenas, *Hitchcock* 5728.

QUERÉTARO: Querétaro, *Hitchcock* 5838.

COLIMA: Jala, *Hitchcock* 7011. Alzada, *Hitchcock* 7097, 7106. Without locality, *Palmer* 19 in 1897.

VERACRUZ: Misantla, *Purpus* 5979. Córdoba, *Finck* in 1893, *Hitchcock* 6448.

Baños del Carrizal, *Purpus* 6218. Santa María Tlatetla, *Liebmann* 279.

OAXACA: Tomellín, *Rose*, *Painter & Rose* 10077, *Hitchcock* 6214. Totalcingo, *Liebmann* 277.

CHIAPAS: Vicinity of Topana, *Nelson* 2874. Between San Ricardo and Ocozucuantla, *Nelson* 2958.

YUCATÁN: Mérida, *Schott* 384.

BRITISH HONDURAS: Manatee Lagoon, *Peck* 317 (*Gray Herb.*).

GUATEMALA: Nenton, *Seler* 2704.

Gualán, *Deam* 6267. Finca

Trece Aguas, *Goll* 81. Chic-

arao, *Heyde & Lux* 6404. Escuintla, *Smith* 2233.

HONDURAS: San Pedro Sula, *Thieme* 195, 5584. Highland Creek, *Wilson* 644.

SALVADOR: La Unión, *Hitchcock* 8778.

NICARAGUA: Jinotepe, *Hitchcock* 8670. Masaya, *Hitchcock* 8663. Without locality, *Flint* in 1868.

COSTA RICA: Puerto Viejo, *Biolley* 7471. Nuestro Amo, Alajuela, *Jiménez* 525. Hacienda la Estrella, *Tonduz* 190. Puntarenas, *Hitchcock* 8552. Puerto de Río Grande, *Pittier* 2035. Nicoya, *Tonduz* 13749. Matina, *Pittier* 9727.

PANAMA: Laguna de Chiriquí, *Hart* 78. Taboga Island, *Pittier* 3626, *Hitchcock* 8076, 8079. Gatun, *Hitchcock* 9185. Toro Point, *Hitchcock* 8057. Culebra, *Hitchcock* 7908, 7932, *Pittier* 2117. David, *Hitchcock* 8358. Porto Bello, *Pittier* 2478. Puerto Obaldía, *Pittier* 4375. Empire, *Pittier* 3718. Las Cascadas, *Pittier* 3743. Chepo, *Pittier* 4695. La Sabana de Panama, *Gervais* 165.

CUBA: Hoyo Colorado, *León* 573. Herradura, *Tracy* 9091. Cienfuegos, *Pringle* 74, 124. San Antonio, *Eggers* 4875. Santiago de Cuba, *León* 813. Banao Hills, *León* 3966. Sancti Spiritus, *León* 916. Sierra de Anafe, *León* 1979. Santiago de las Vegas, *Wilson* 593. Without locality, *Wright* 754.

JAMAICA: Gordon Town, *Hart* 785, 840, *Harris* 11345, 11400. Bath, *Maxon* 2361. Hope Gardens, *Maxon* 1659, *Harris* 11252, 11255, *Hitchcock* 9312, *Amer. Gr. Nat. Herb.* 5. Flamstead, *Harris* 11470. Ferry River, *Harris* 11324, *Hitchcock* 9747. Montego Bay, *Hitchcock* 9682. Savanna-la-Mar, *Hitchcock* 9870. Above Constant Spring, *Hitchcock* 9259. Ewarton to Linstead, *Hitchcock* 9411. Without locality, *Lloyd* 1116, *Wilson* 322.

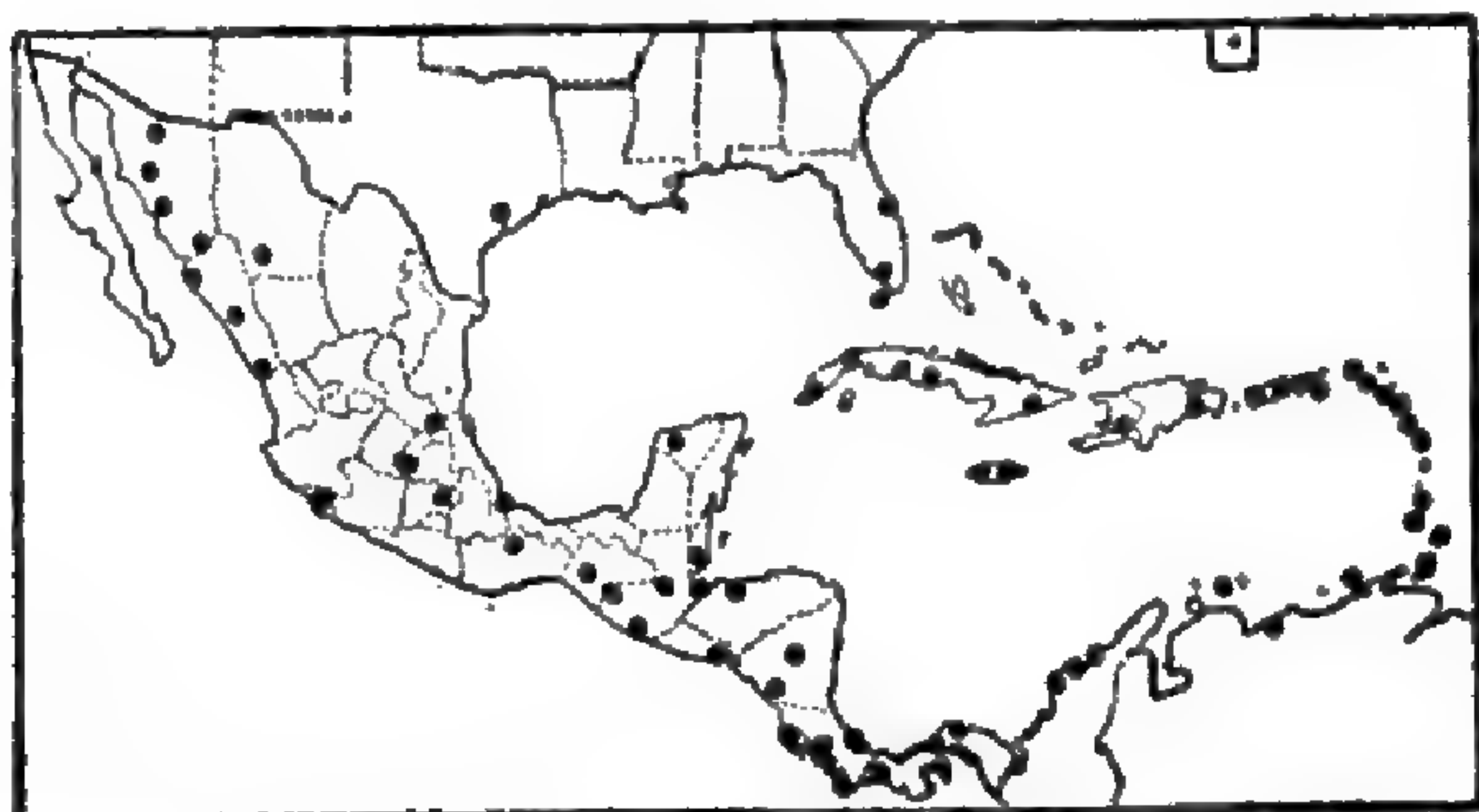


FIG. 19.—Distribution of *P. fasciculatum*.



HAITI: Labrante, *Buch* 48. Without locality, *Picarda* 409, *Christ* 2144. (All in K. U. Herb.).

SANTO DOMINGO: San Pedro de Macoris, *Rose, Fitch & Russell* 4440, 4174.

PORTO RICO: Aibonito, *Underwood & Griggs* 462. Monte Goyo, *Sintenis* 1901. Guanica, *Sintenis* 3647, *Chase* 6523. Rio Piedras, *Barrett* 63, *Heller* 135. Ponce, *Heller* 6226, 6302. Caguas, *Goll* 385. Guayama Road, *Goll* 588. Aguadilla, *Heller* 4528. Maricao, *Chase* 6197. Coamo Springs, *Chase* 6542. Bayamon, *Chase* 6376, *Hioram* 316. Mayaguez, *Chase* 6263. Sierra Luquillo, *Hioram* 357. Culebra, *Britton & Wheeler* 137. Vieques, *Chase* 6693. Without locality, *Fisher* 59, *Underwood & Griggs* 824.

DANISH WEST INDIES: St. Thomas, *Eggers* in 1880 and in 1882. St. Croix, *Rickecker* 317.

LEEWARD ISLANDS: Guadeloupe, *Duss* 2691, *L'Herminier*. Montserrat, *Shafer* 584. St. Kitts, *Britton & Cowell* 269 (K. U. Herb.). Dominica, *Duss* (K. U. Herb.).

WINDWARD ISLANDS: Martinique, *Duss* 537, 538, *Hahn* in 1867-70. Grenada, *Broadway* in 1905. St. Vincent, *Smith & Smith* 565 (K. U. Herb.).

TRINIDAD: St. Joseph, *Hitchcock* 10014. Port of Spain, *Hitchcock* 9976. Without locality, *Bot. Gard. Herb.*<sup>1</sup> 2283, 3192.

TOBAGO: Mount Marie, *Broadway* 3977. Rockley Vale, *Broadway* 4630. Scarborough, *Hitchcock* 10216.

CURAÇAO: Santa Catherina, *Britton & Shafer* 3145. Bonaire, *Suringar* in 1885 (K. U. Herb.).

VENEZUELA: Paparo, *Pittier* 6336. Island of Margarita, *Miller & Johnston* 180.

COLOMBIA: Puerto de Colombia, *Hitchcock* 9934. Río Frío, State of Magdalena, *Pittier* 1610. Cartagena, *Hitchcock* 9911. Santa Marta, *Smith* 131, 208.

#### 9a. *Panicum fasciculatum reticulatum* (Torr.) Beal.

*Panicum reticulatum* Torr. in Marcy, Expl. Red Riv. 299. 1852.

*Panicum fasciculatum reticulatum* Beal, Grasses N. Amer. 2: 117. 1896.

For further treatment see Contr. U. S. Nat. Herb. 15: 40. 1910 (where this is included under *P. fasciculatum chartaginense* (Swartz) Doell); see also discussion under *P. fasciculatum*.

#### DISTRIBUTION.

Prairies, fields, and waste grounds, Texas to Arizona and southern Mexico. The type specimen from Texas.



FIG. 20.—Distribution of *P. fasciculatum reticulatum*.

SONORA: Guaymas, *Hitchcock* 3561.

CHIHUAHUA: Chihuahua, *Pringle* 379, 380.

COAHUILA: Sabinas, *Nelson* 6818.

NUEVO LEÓN: Monterrey, *Hitchcock* 5535, 5541.

TAMAULIPAS: Victoria, *Palmer* 412 in 1907.

TEPIC: Acaponeta, *Rose, Standley & Russell* 14265.

SAN LUIS POTOSÍ: San Dieguito, *Palmer* 152 in 1904.

COLIMA: Manzanillo, *Hitchcock* 7029.

PUEBLA: Tehuacán, *Hitchcock* 6050.

OAXACA: Ignacia Mejía, *Hitchcock* 6115. Tomellín, *Hitchcock* 6195.

<sup>1</sup> Herbarium of the Botanical Garden, Trinidad. Many specimens are without data other than the number.



# 10. *Panicum molle* Swartz.

*Panicum molle* Swartz, Prodr. Veg. Ind. Occ. 22. 1788; Contr. U. S. Nat. Herb. 15: 42. 1910.

## DISTRIBUTION.

Open ground, often a weed in fields, Cuba, Jamaica, Mexico, and Central America to Argentina. The type from the West Indies, probably Jamaica. Since at the time the revision of *Panicum*<sup>1</sup> was prepared we had no specimens of the species from the West Indies, we doubted the accuracy of the locality given by Swartz. This species proves, however, to be not uncommon in the vicinity of Kingston, Jamaica.

SINALOA: Lodiago, *Palmer* 1660 in 1891.

COLIMA: Manzanillo, *Amer. Gr. Nat. Herb.* 7. Alzada, *Hitchcock* 7107. Colima, *Palmer* 149 in 1897.

VERACRUZ: Without locality, *Galeotti* 5710.

GUERRERO: Balsas, *Hitchcock* 6813.

OAXACA: Tomellín, *Hitchcock* 6205, 6229.

GUATEMALA: Agua Caliente, *Deam* 6143.

SALVADOR: San Salvador, *Hitchcock* 8860.

COSTA RICA: Puntarenas, *Hitchcock* 8585.

PANAMA: Point Chamé, *Amer. Gr. Nat. Herb.* 8. Taboga Island, *Hitchcock* 8067.

CUBA: Without locality, *Reed*.

JAMAICA: Kingston, *Alexander* in 1849, *Hitchcock* in 1890. Gordon Town, *Harris* 11504, *Hitchcock* 9323. St. Andrew, *Harris* 11483. Healthshire Hills, *Hitchcock* 9758. Hope Gardens, *Amer. Gr. Nat. Herb.* 9.

CURAÇAO: Santa Cruz, *Britton & Shafer* 2986, 3004. Aruba, *Suringar* in 1885. (K. U. Herb.)

COLOMBIA: Santa Marta, *Smith* 209. Cartagena, *Hitchcock* 9922. Puerto de Colombia, *Hitchcock* 9940.



FIG. 21.—Distribution of *P. molle*.

# 11. *Panicum adspersum* Trin.

*Panicum adspersum* Trin. Gram. Pan. 146. 1826; Contr. U. S. Nat. Herb. 15: 43. 1910.

## DISTRIBUTION.

Moist open ground, Florida and the West Indies. The type specimen from Santo Domingo.

BAHAMAS: Nassau, *Curtiss* 113. Anguilla Isles, *Wilson* 8066.

CUBA: Habana Vedado, *León* 291, 1978. Habana, *León* 570, *Curtiss* 748. Santiago de las Vegas, *Baker & Wilson* 512, *Tracy* 9109, *Hitchcock* 147, 148. Tricornia, *Hitchcock* 159. Cabanas, *Palmer & Riley* 746, 771. Herradura, *Tracy* 9102. Sancti Spiritus, *León* 925. Guines, *León* 924. Zaza del Sur, *Sergius* 2776. Without locality, *Wright* 3869.



FIG. 22.—Distribution of *P. adspersum*.

<sup>1</sup> Contr. U. S. Nat. Herb. 15: 42. 1910.



JAMAICA: Black River, *Hitchcock* 9630. Hope Gardens, *Amer. Gr. Nat. Herb.* 10, 11, *Harris* 11247. Kingston, *Hitchcock* 9750. Alligator Pond, *Hitchcock* 9830. Gordon Town, *Harris* 11343, 11512. Yallahs Valley, *Harris* 11498.

HAITI: Gonaïves, *Buch* 23.

SANTO DOMINGO: Barahona, *Fuertes* 43.

PORTO RICO: Between Coamo and Aibonito, *Sintenis* 1957, *Chase* 6333. Joyuda, *Chase* 6302. Guanica, *Chase* 6514. Mayaguez, *Chase* 6286. Bayamon, *Hioram* 315. Vieques, *Chase* 6686.

DANISH WEST INDIES: St. Croix, *Eggers* in 1876, *Ricksecker* 66, 384.

LEEWARD ISLANDS: Antigua, *Wulfschlaegel* 615, 616. Guadeloupe, *Duss* 3180. Saba, *Boldingh* 1583 (K. U. Herb.). St. Eustatius, *Suringar* in 1885 (K. U. Herb.). St. Bartholomew, *Goës* (K. U. Herb.).

WINDWARD ISLANDS: *Duss* 537b (K. U. Herb.).

## 12. *Panicum arizonicum* Scribn. & Merr.

*Panicum arizonicum* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 32: 2. 1901; Contr. U. S. Nat. Herb. 15: 44. 1910.

### DISTRIBUTION.

Open sandy or stony ground, southwestern United States and northern Mexico. The type specimen from Arizona.

LOWER CALIFORNIA: Arroyo San Lazaro, *Brandeggee* in 1902. San José del Cabo, *Brandeggee* in 1890.



FIG. 23.—Distribution of *P. arizonicum*.

SONORA: Nogales, *Griffiths* 6747, 6759, *Hitchcock* 3637. Lokuka Ranch to Altar, *Griffiths* 6891. Guaymas, *Palmer* 159 and 208 in 1887. *Hitchcock* 3562. Hermosillo, *Hitchcock* 3542.

CHIHUAHUA: Norogachi, *Palmer* 1B in 1885. Chihuahua, *Pringle* 487.

SINALOA: Topolobampo, *Palmer* 250 in 1897.

DURANGO: Without locality, *Rose* 2280.

GUERRERO: Río Balsas, *Orcutt* 4195. Balsas, *Hitchcock* 6775.

OAXACA: Tomellín, *Hitchcock* 6192, *Amer. Gr. Nat. Herb.* 13.

## 13. *Panicum texanum* Buckl.

*Panicum texanum* Buckl. Prel. Rep. Geol. Agr. Surv. Tex. App. 3. 1866; Contr. U. S. Nat. Herb. 15: 46. 1910.

### DISTRIBUTION.

Prairies and open ground, often a weed in fields, Texas and northern Mexico. The type specimen from Texas.

NUEVO LEÓN: Monterrey, *Hitchcock* 5540.



FIG. 24.—Distribution of *P. texanum*.



DICHOTOMIFLORA.

Three species of this group, *Panicum aquaticum*, *P. sucosum*, and *P. elephantipes*, are found to be perennial.

Plants annual.

Panicles narrow, less than 1 cm. wide..... 14. *P. vaseyanum*.

Panicles open, the branches ascending or spreading.

Sheaths glabrous..... 15. *P. dichotomiflorum*.

Sheaths papillose-hispid..... 16. *P. bartowense*.

Plants perennial.

Fruit not acuminate; panicles rarely over 18 cm. long... 17. *P. aquaticum*.

Fruit acuminate; panicles as much as 40 cm. long, rarely less than 20 cm.; culms succulent.

Spikelets about 3.5 mm. long; fruit abruptly acuminate..... 18. *P. sucosum*.

Spikelets 4 to 5 mm. long; fruit long-acuminate; culms very succulent..... 19. *P. elephantipes*.

14. *Panicum vaseyanum* Scribn.

*Panicum vaseyanum* Scribn.; Beal, Grasses N. Amer. 2: 140. 1896; Contr. U. S. Nat. Herb. 15: 47. 1910.

DISTRIBUTION.

Moist open ground, around ponds and depressions in prairies, northern Mexico. The type specimen from Chihuahua.

CHIHUAHUA: Base of Sierra Madre, Pringle 1415. Miñaca, Hitchcock 7757.

AGUASCALIENTES: Aguascalientes, Hitchcock 7491, Amer. Gr. Nat. Herb. 15.

JALISCO: Guadalajara, Hitchcock 7315.



FIG. 25.—Distribution of *P. vaseyanum*.

15. *Panicum dichotomiflorum* Michx.

*Panicum dichotomiflorum* Michx. Fl. Bor. Amer. 1: 48. 1803; Contr. U. S. Nat. Herb. 15: 48. 1910.

The South American *Panicum chloroticum* Nees, included in the Revision in *P. dichotomiflorum*, is a distinct species, or possibly a subspecies. It is not known from north of Brazil.

DISTRIBUTION.

Moist ground along streams and a weed in waste places and in cultivated soil, Maine to Florida and California (rare in the West), and in the West Indies and Panama. The type specimen from the Alleghenies.

PANAMA: Near Chepo, Pittier 4614. Gatun, Hitchcock 7977.

BERMUDA: Hamilton, Millspaugh 126.

BAHAMAS: Hog Island, Eggers 4405, 4512. Watlings, Geogr. Soc. Baltimore 489. Nassau, Curtiss 177. Cat Cay, Brace 3742.



FIG. 26.—Distribution of *P. dichotomiflorum*.



CUBA: Herradura, *Tracy* 9055, 9342, *Britton & Earle* 6566. Ariguanabo, *León* 1975½, 2774, 2775. Santiago de las Vegas, *Hitchcock* 151. Batabanó, *Hitchcock* 150. LEEWARD ISLANDS: Guadeloupe, *Duss* 3178.

**16. *Panicum bartowense* Scribn. & Merr.**

*Panicum bartowense* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. **35**: 3. 1901; Contr. U. S. Nat. Herb. **15**: 52. 1910.

DISTRIBUTION.

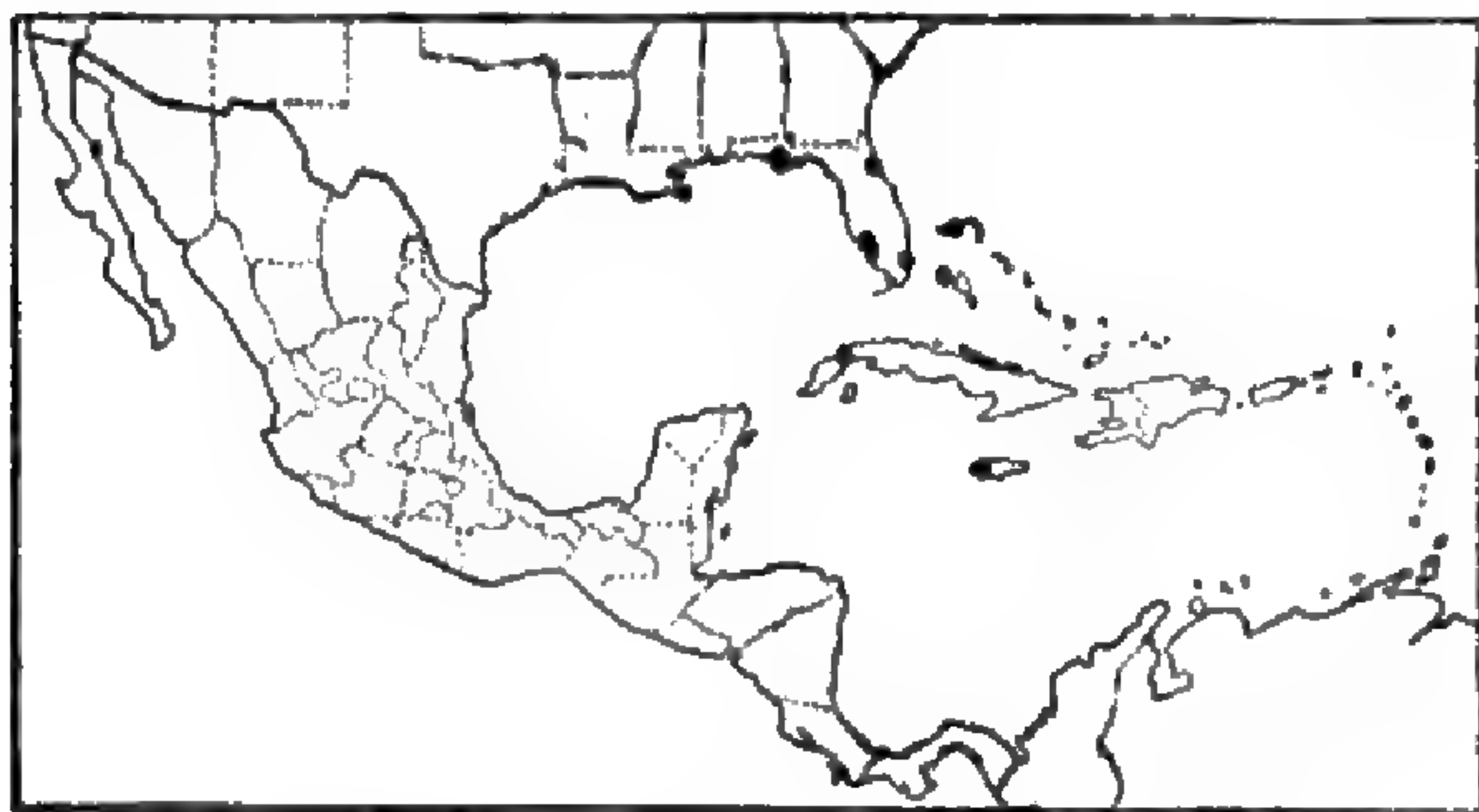


FIG. 27.—Distribution of *P. bartowense*.

Low ground, often growing in shallow water, Florida, Bahamas, Cuba, and Jamaica. The type specimen from Bartow, Florida.

BAHAMAS: Great Bahama, *Britton & Millspaugh* 2706. North Bimini, *Brace* 3467 (Field Mus. Herb.).

CUBA: Batabanó, *Hitchcock* 149. Without locality, *Wright* 3860.

JAMAICA: Black River, *Amer. Gr. Nat. Herb.* 18.

**17. *Panicum aquaticum* Poir.**

*Panicum aquaticum* Poir. in Lam. Encycl. Suppl. **4**: 281. 1816. "Cette plante croît à Porto-Ricco; elle m'a été communiquée par M. Ledru." The type is in the Cosson Herbarium. In the Revision<sup>1</sup> this species was included in *P. dichotomiflorum* Michx. Subsequent field study has shown it to be a perennial.

*Panicum chloroticum sylvestre* Nees; Trin. Gram. Pan. 236. 1826; Contr. U. S. Nat. Herb. **15**: 48. 1910.

*Panicum hygrophilum* Salzm.; Steud. Syn. Pl. Glum. **1**: 71. 1854; Contr. U. S. Nat. Herb. **15**: 49. 1910.

*Panicum proliferum strictum* Griseb. Cat. Pl. Cub. 232. 1866; Contr. U. S. Nat. Herb. **15**: 49. 1910.

DESCRIPTION.

Plants perennial, mostly aquatic, glabrous except as noted; culms usually decumbent at base, rooting at the nodes, erect branches often arising therefrom, the flowering culms erect, simple or sparingly branching, averaging lower and more slender than in *P. dichotomiflorum*; sheaths usually overlapping, rarely pilose at the junction with the blade; ligule a ring of hairs about 1 mm. long; blades commonly elongated, as much as 25 cm. long, but sometimes 5 to 10 cm. long and abruptly pointed, 5 to 10 mm. wide, linear, acute, occasionally sparsely pilose on the upper surface toward the base; panicles terminal and axillary, short-exserted or included at base, averaging smaller than those of *P. dichotomiflorum*, rarely as much as 20 cm. long, less freely branching and fewer flowered, the branchlets and pedicels smooth or nearly so on the angles; spikelets 3 to 3.4 mm. long, 1 mm. wide, more gradually pointed than those of *P. dichotomiflorum*, the fruit slightly larger and more pointed than in that species.

Herbarium specimens lacking basal parts are difficult to distinguish from *P. dichotomiflorum*.

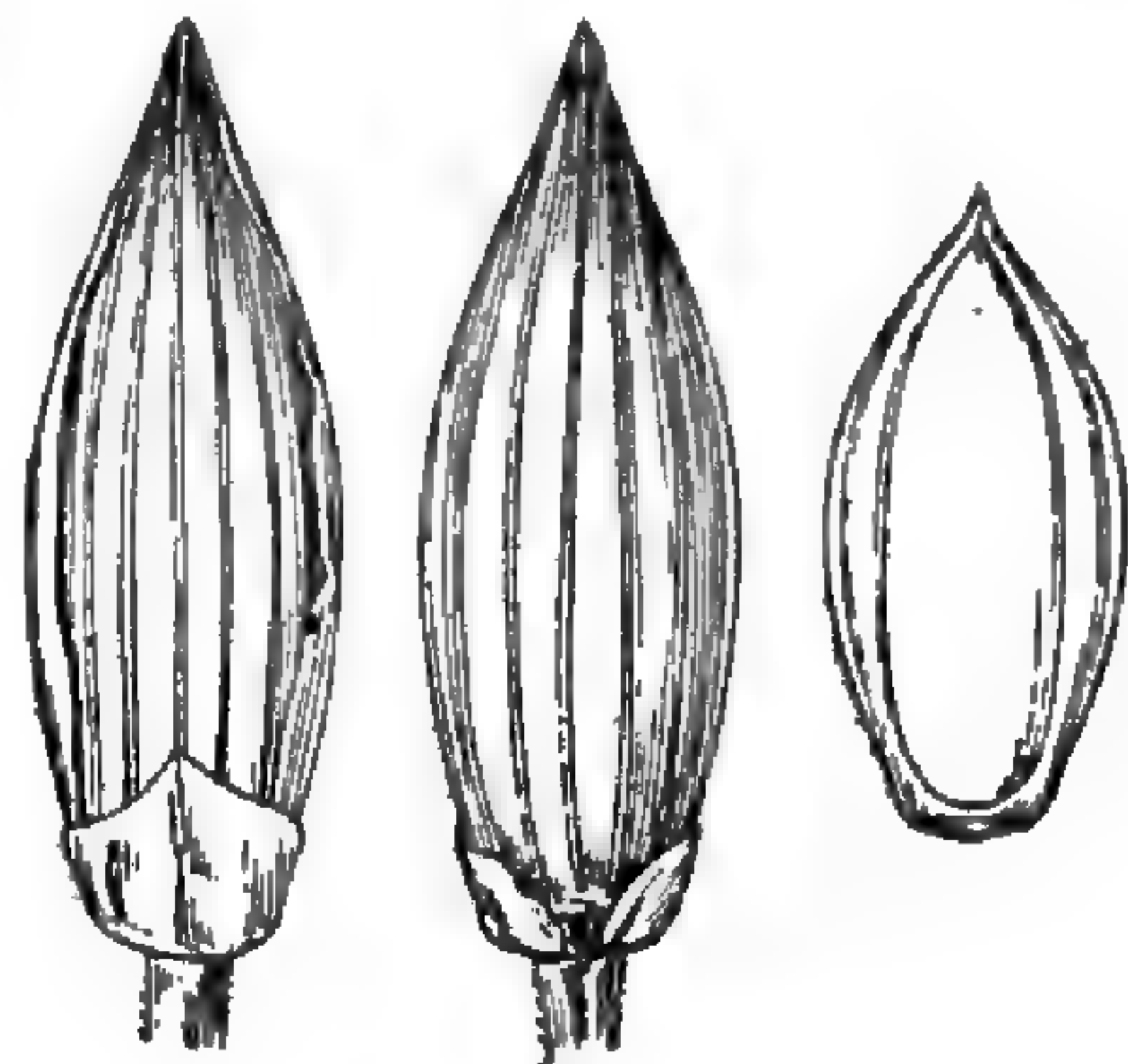


FIG. 28.—*P. aquaticum*. From type specimen.

<sup>1</sup> Contr. U. S. Nat. Herb. **15**: 48. 1910.



## DISTRIBUTION.

Wet places or in shallow water, margins of streams and ponds, mostly at low altitudes, Cuba, Porto Rico, and Mexico to Trinidad and Paraguay.

COLIMA: Alzada, *Hitchcock* 7067.

GUATEMALA: Puerto Barrios, *Hitchcock* 9147.

CUBA: Guanabacoa, *León* 919.

Ariguanabo, *León* 1975, 1976.

Habana, *León* 4155. El Caño,

*León* 1974. Laguna Jovero,

*Shafer* 10912. Without local-

ity, *Wright* 3456 in part, 3861.

PORTO RICO: Laguna del Tortu-

guero, *Chase* 6804. Lake Loisa,

*Chase* 6778. Alto de Bandera, *Chase* 6471. Utuado, *Britton & Cowell* 432.

LEEWARD ISLANDS: Guadeloupe, *Duss* 3178 (K. U. Herb.).

TRINIDAD: Pitch Lake, *Hitchcock* 10099.



FIG. 29.—Distribution of *P. aquaticum*.

18. *Panicum sucosum* sp. nov.

## DESCRIPTION.

Plants perennial, glabrous throughout except as noted; culms few to several in a tuft, 1 to 1.5 meters long, decumbent at base and rooting at the lower nodes, succulent; sheaths rather loose, about as long as the internodes; ligule a densely ciliate membrane about 1 mm. long; blades flat or somewhat involute in drying, 15 to 30 cm. long, 3 to 9 mm. wide, linear, acuminate, scaberulous on both surfaces, sparsely pilose

above toward the base; panicle 15 to 30 cm. long, about half as wide, the axis and branches somewhat scabrous, the branches solitary or in pairs, rather stiffly spreading or finally horizontal, as much as 15 cm. long, naked at base for 1 or 2 cm., the internodes of the rachis mostly 3 to 5 cm. long, the branchlets appressed or ascending, mostly from the lower side; spikelets short-pedicelled, somewhat appressed to the rachis, 3.3 to 3.7 mm. long, about 1 mm. wide, lanceolate, acuminate, glabrous; first glume one-fourth to nearly one-third the length of the spikelet, broadly triangular, usually subacute, 3-nerved; second glume and sterile lemma subequal, exceeding the fruit and pointed beyond it, 7 to 9-nerved; fruit about 2.5 mm. long, 0.7 mm. wide, rather abruptly acuminate.

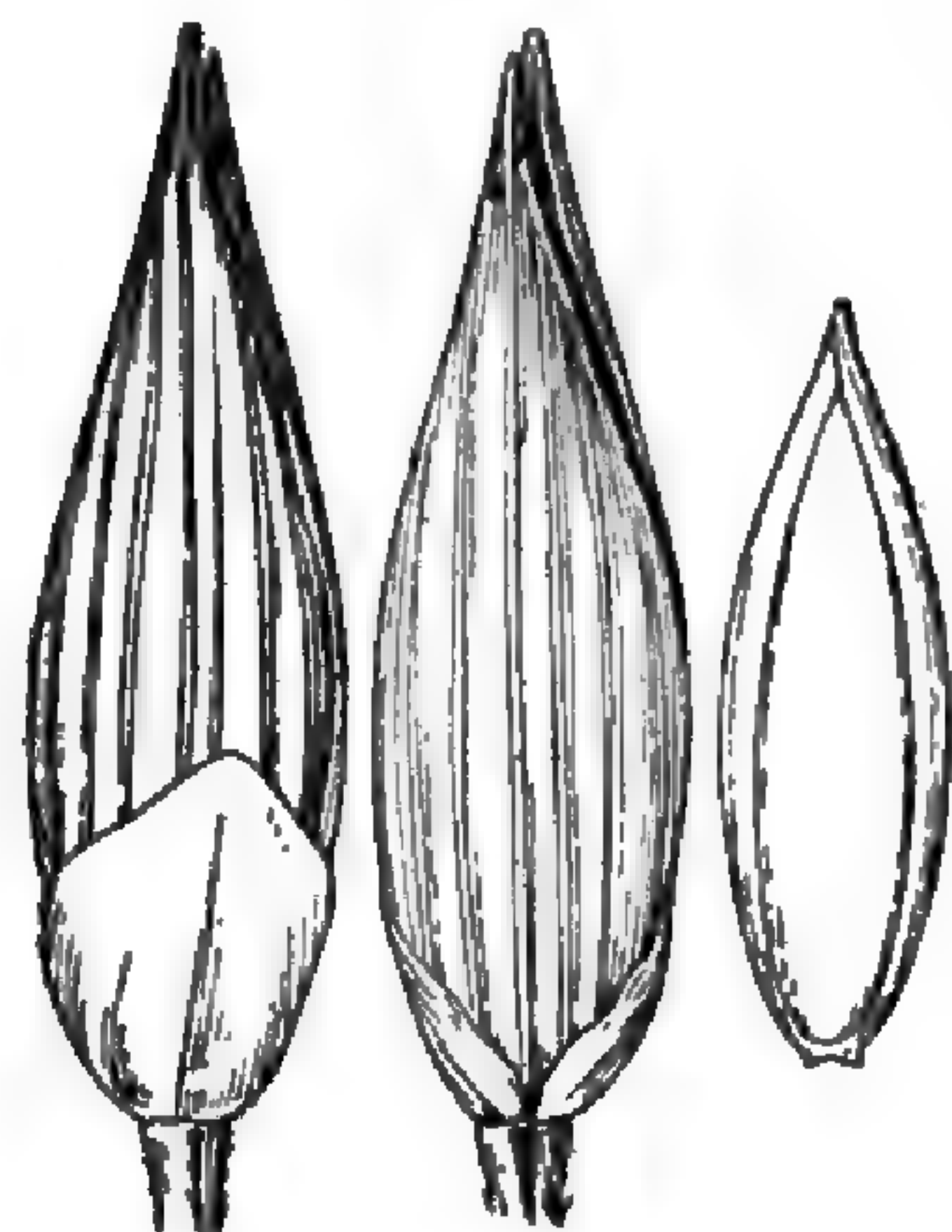


FIG. 30.—*P. sucosum*. From type specimen.

Type in the U. S. National Herbarium, no. 693325, collected in water of a pond at Orozco, near Guadalajara, Jalisco, Mexico, September 29, 1910, by A. S. Hitchcock (no. 7379).

This species, which in the Revision <sup>1</sup> was included in *P. elephantipes*, differs from *P. dichotomiflorum* in being perennial and in having larger spikelets; from *P. aquaticum* in its larger panicle and more pointed spikelets and fruit; from *P. elephantipes* in having smaller, less succulent culms with narrower blades and in having less acuminate fruit.

<sup>1</sup> Contr. U. S. Nat. Herb. 15: 54. 1910.



FIG. 31.—Distribution of *P. sucosum*.

## DISTRIBUTION.

In water of ponds at high altitudes, southern Mexico.

JALISCO: Orozco, *Hitchcock* 7379.

MÉXICO: Near Mexico City, *Orcutt* 4269, *Pringle* 6322, 9577, *Bourgeau* 529.

REPUBLIC OF MEXICO: Without locality, *Schaffner* 525

19. *Panicum elephantipes* Nees.

*Panicum elephantipes* Nees, Agrost. Bras. 165. 1829; Contr. U. S. Nat. Herb. 15: 53. 1910.

Field study has shown that this species is perennial.

## DISTRIBUTION.

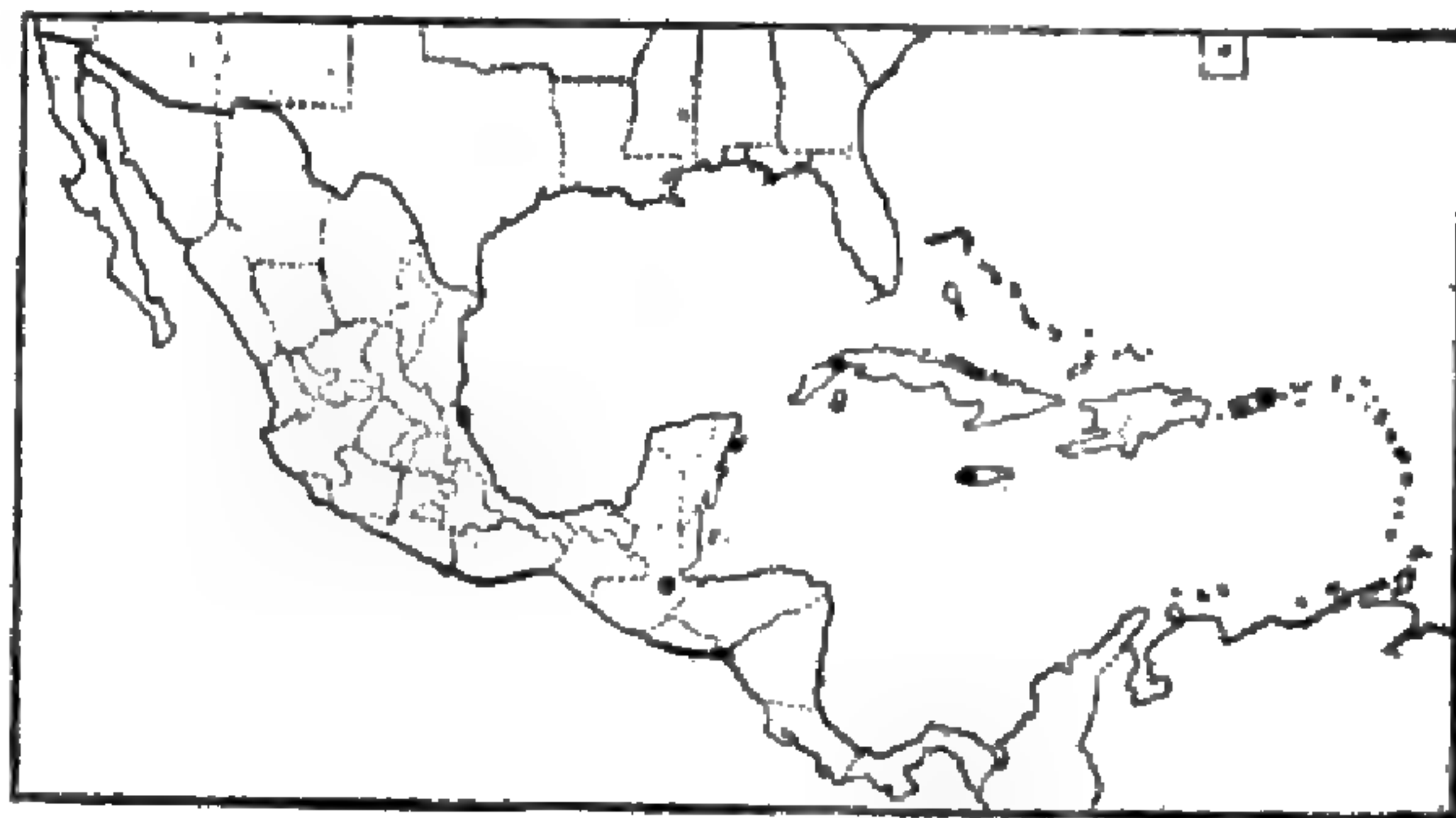
In ponds and shallow water at low altitudes, West Indies and Guatemala, south to Argentina. The type specimen from Brazil.

GUATEMALA: Near mouth of Río Polochic, Alta Verapaz, *Goll* 35A.

CUBA: San Antonio, *Hitchcock* 152. Almendares River, *León* 335.

JAMAICA: Middle Quarters, on Black River, *Amer. Gr. Nat. Herb.* 19. Savanna-la-Mar, *Hitchcock* 9878.

PORTO RICO: Between Cataño and Bayamon, *Chase* 6407. Dorado, *Chase* 6415. Fajardo, *Sintenis* 938.

FIG. 32.—Distribution of *P. elephantipes*.

## CAPILLARIA.

Panicles more or less drooping..... 25. *P. sonorum*.

Panicles erect.

Inflorescence elongated, composed of several approximate, implicate panicles..... 27. *P. cayennense*.

Inflorescence not composed of approximate nor implicate panicles.

Panicles more than half the length of the entire plant.. 20. *P. capillare*.

Panicles not more than one-third the entire height of the plant.

First glume about one-third the length of the spikelets, subacute or blunt..... 24. *P. stramineum*.

First glume usually more than half the length of the spikelet, acuminate.

Spikelets 4.5 to 6 mm. long.

Spikelets 6 mm. long, scattered..... 26. *P. parvum*.

Spikelets scarcely over 5 mm. long, approximate..... 23. *P. decolorans*.

Spikelets not over 4 mm. long.

First glume more than three-fourths the length of the spikelet; spikelets 4 mm. long ..... 22. *P. pampinosum*.

First glume half to two-thirds the length of the spikelet; spikelets not over 3.3 mm. long..... 21. *P. hirticaule*.



20. *Panicum capillare* L.

*Panicum capillare* L. Sp. Pl. 58. 1753;  
Contr. U. S. Nat. Herb. 15: 60. 1910.

## DISTRIBUTION.

Open ground, common in eastern United States, introduced in Bermuda. The type specimen from Virginia.

BERMUDA: North Shore Road,  
*Brown & Britton* 21.

FIG. 33.—Distribution of *P. capillare*.21. *Panicum hirticaule* Presl.

*Panicum hirticaule* Presl, Rel. Haenk. 1: 308. 1830; Contr. U. S. Nat. Herb. 15: 64. 1910.

## DISTRIBUTION.

Rocky or sandy soil, southwestern United States and south through Mexico to South America; also in Haiti. The type specimen from Acapulco, Mexico.

LOWER CALIFORNIA: San José del Cabo, *Brandeggee* 42. Purísima, *Brandeggee* in 1889.

SONORA: Nogales, *Hitchcock* 3631, *Griffiths* 6758, 6799. Lokuka Ranch to Altar, *Griffiths* 6892. Llano, *Hitchcock* 3526. Johnstons Ranch, east of San Pedro River, *Merton* 1705. Guaymas, *Hitchcock* 3547, 3553, *Palmer* 208 and 346 in 1887. Alamos, *Palmer* 690, 695, and 750 in 1890. White Water, *Mearns* 2294. Sonora, *Hitchcock* 3541½. Hermosillo, *Hitchcock* 3541, 3573, 3604.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 1b in 1885. Between Casas Grandes and Sabinal, *Nelson* 6355. Sierra Madre, *Nelson* 6297.

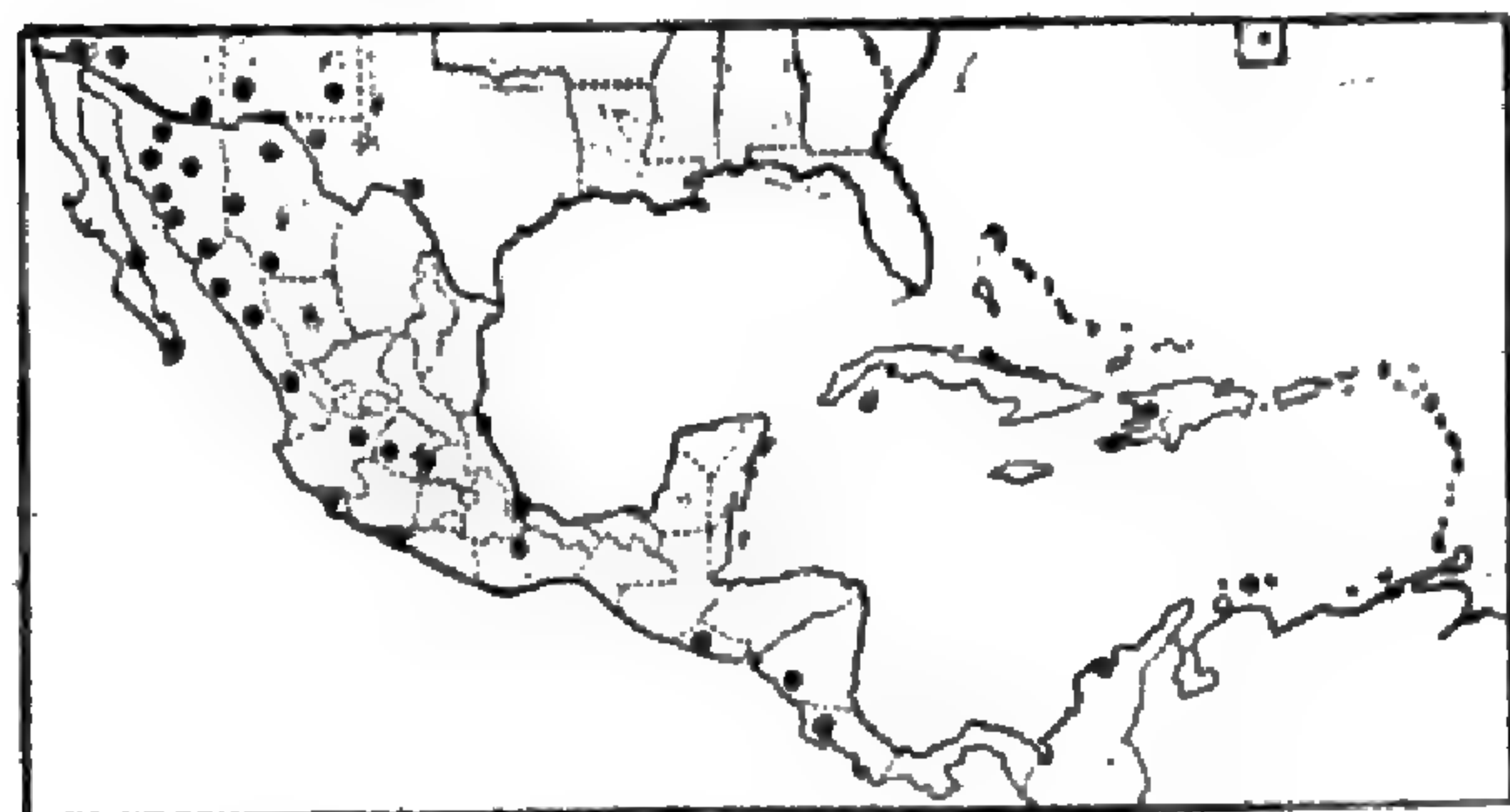
SINALOA: Culiacán, *Palmer* 1544, 1545, and 1554 in 1891. Topolobampo, *Palmer* 249 and 251 in 1897.

TEPIC: Between Aguacate and Dolores, *Rose* 3351.

JALISCO: Guadalajara, *Hitchcock* 7357.

GUANAJUATO: Irapuato, *Hitchcock* 7424.

QUERÉTARO: Querétaro, *Hitchcock* 5846.

FIG. 34.—Distribution of *P. hirticaule*.

COLIMA: Alzada, *Hitchcock* 7089, 7096, 7104. Without locality, *Palmer* 14, 143, and 145 in 1897.

VERACRUZ: Baños del Carrizal, *Purpus* 6212.

GUERRERO: Balsas, *Hitchcock* 6773, 6814, 6815. Río Balsas, *Orcutt* 4197.

OAXACA: Tomellín, *Hitchcock* 6248, *Amer. Gr. Nat. Herb.* 28.

SALVADOR: La Unión, *Hitchcock* 8794. West side of Lake Ilopango, *Hitchcock* 8924.

NICARAGUA: Masaya, *Hitchcock* 8654. Without locality, *Flint* in 1868.

COSTA RICA: Atenas, *Hitchcock* 8517.

HAITI: Near the River Artibonite, *Picarda* 1654.

CURAÇAO: *Boldingh* 5379.

COLOMBIA: Puerto de Colombia, *Hitchcock* 9927.



**22. *Panicum pampinosum* Hitchc. & Chase.**

*Panicum pampinosum* Hitchc. & Chase, Contr. U. S. Nat. Herb. **15**: 66. 1910.  
Culms 15 to 40 cm. high, ascending from a decumbent base or widely spreading.

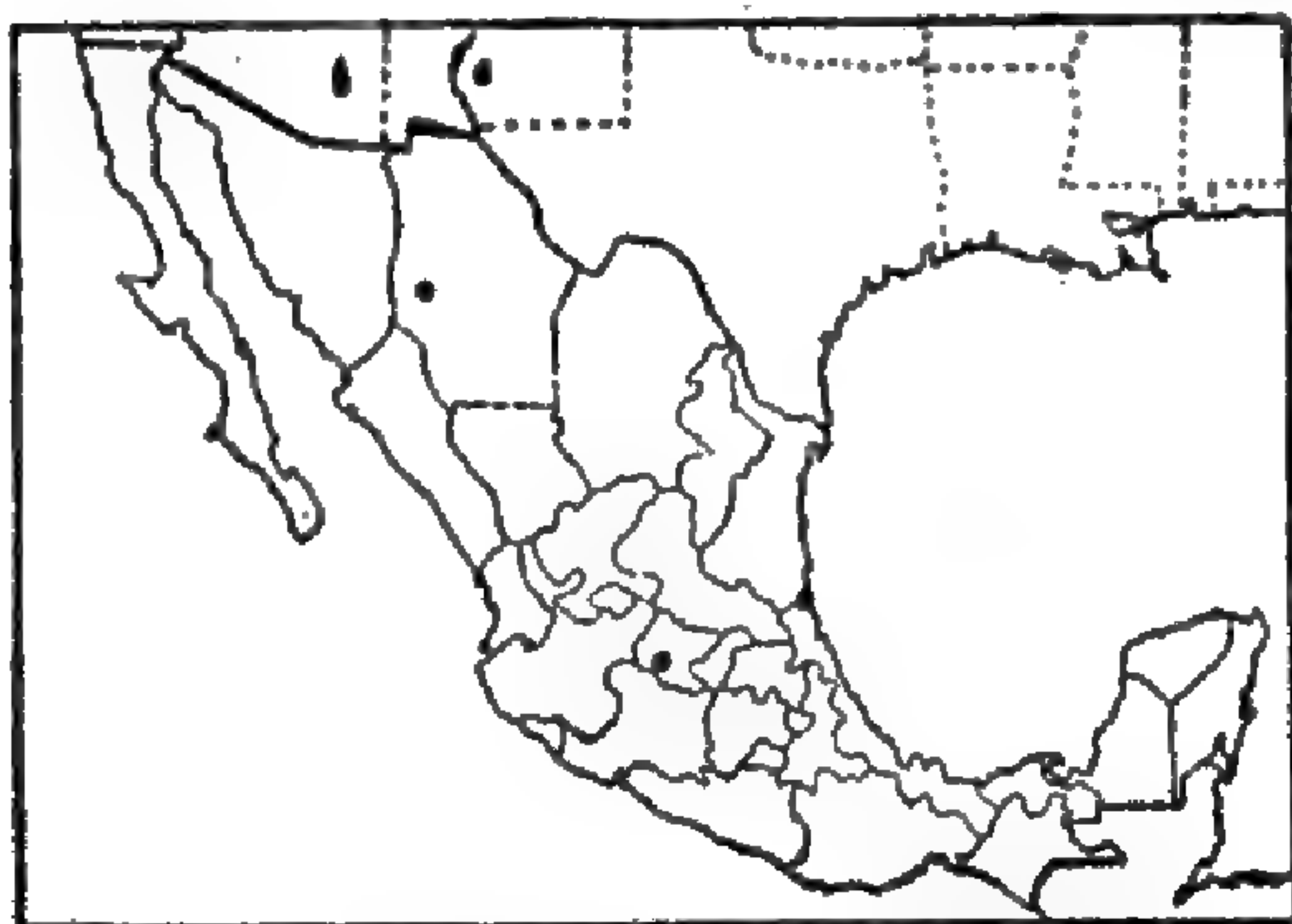


FIG. 35.—Distribution of *P. pampinosum*.

## DISTRIBUTION.

Open ground and depressions in mesas, southwestern United States to central Mexico. The type specimen from Arizona.

CHIHUAHUA: Miñaca, *Hitchcock* 7751, 7756.

GUANAJUATO: Acámbaro, *Hitchcock* 6952.

**23. *Panicum decolorans* H. B. K.**

*Panicum decolorans* H. B. K. Nov. Gen. & Sp. **1**: 100. 1816; Contr. U. S. Nat. Herb. **15**: 66. 328. 1910.

## DISTRIBUTION.

Fields and waste ground, central Mexico. The type specimen from Querétaro.

SAN LUIS POTOSÍ: Cárdenas, *Amer. Gr. Nat. Herb.* 29.

QUERÉTARO: Querétaro, *Basile* 51, 52, *Hitchcock* 5822, 5864.

PUEBLA: Tehuacán, *Hitchcock* 6057.



FIG. 36.—Distribution of *P. decolorans*.

**24. *Panicum stramineum* Hitchc. & Chase.**

*Panicum stramineum* Hitchc. & Chase, Contr. U. S. Nat. Herb. **15**: 67. 1910.

This species was described as having glabrous (or sometimes ciliate) blades. Later collections show that the blades are sometimes sparsely papillose-pilose.



FIG. 37.—Distribution of *P. stramineum*.

## DISTRIBUTION.

Rich bottom lands and damp soil, Arizona to Michoacán. The type specimen from Guaymas.

SONORA: Guaymas, *Palmer* 168a and 206 in 1887.

SINALOA: Culiacán, *Palmer* 1538 in 1891. Between Rosario and Acaponeta, *Rose* 1878, 1883.

DURANGO: Durango, *Hitchcock* 7658.

TEPIC: Between Concepción and Acaponeta, *Rose* 1889. Acaponeta, *Rose* 3281.

MICHOACÁN: Morelia, *Arsène* 60, 2985.

GUERRERO: Lagunillas, *Langlasse* 263.<sup>1</sup>

<sup>1</sup> In the Revision this specimen was doubtfully referred to *P. filipes* Scribn. (Contr. U. S. Nat. Herb. **15**: 74. 1910).



**25. *Panicum sonorum* Beal.**

*Panicum sonorum* Beal, Grasses N. Amer. **2**: 130. 1896; Contr. U. S. Nat. Herb. **15**: 67. 1910.

DISTRIBUTION.

Rich bottom land, northwestern Mexico. The type specimen from Lerdo.

SONORA: Lerdo, *Palmer* 947 in 1889.

Without locality, *Palmer* in 1885.

CHIHUAHUA: Southwestern Chihuahua, *Palmer* 1c in 1885.

SINALOA: Culiacán, *Palmer* 1539 and 1554 in 1891.

CHIAPAS: Between San Ricardo and Ocozucuantla, *Nelson* 2959.



FIG. 38.—Distribution of *P. sonorum*.

**26. *Panicum parcum* Hitchc. & Chase.**

*Panicum parcum* Hitchc. & Chase, Contr. U. S. Nat. Herb. **15**: 68. 1910.

DISTRIBUTION.

Open rocky soil, Sinaloa to Guerrero. The type specimen from Sinaloa.

SINALOA: Lodiago, *Palmer* 1657. Copradía, *Brandegge* in 1904.

COLIMA: Alzada, *Orcutt* 4687, *Hitchcock* 7081.

GUERRERO: Balsas, *Hitchcock* 6808, 6810, 6811, *Amer. Gr. Nat. Herb.* 30.



FIG. 39.—Distribution of *P. parcum*.

**27. *Panicum cayennense* Lam.**

*Panicum cayennense* Lam. Tabl. Encycl. **1**: 173. 1791; Contr. U. S. Nat. Herb. **15**: 70. 1910.

DISTRIBUTION.

Open ground and pine woods, Cuba, Costa Rica to Brazil. The type from French Guiana.

COSTA RICA: Buenos Aires, *Tonduz* 3685.

PANAMA: Dolega, *Hitchcock* 8335. David, *Amer. Gr. Nat. Herb.* 31.

CUBA: Isle of Pines, *Curtiss* 267, *Taylor* 34, *Palmer & Riley* 1086. Herradura, *Tracy* 9073, *Britton, Earle & Gager* 6520. Sierra de Cabra, *Britton, Earle & Gager* 7275. Laguna Jovero, *Shafer* 10910. Sumidero, *León & Shafer* 13717. Pinar del Río, *Wright* 3865.

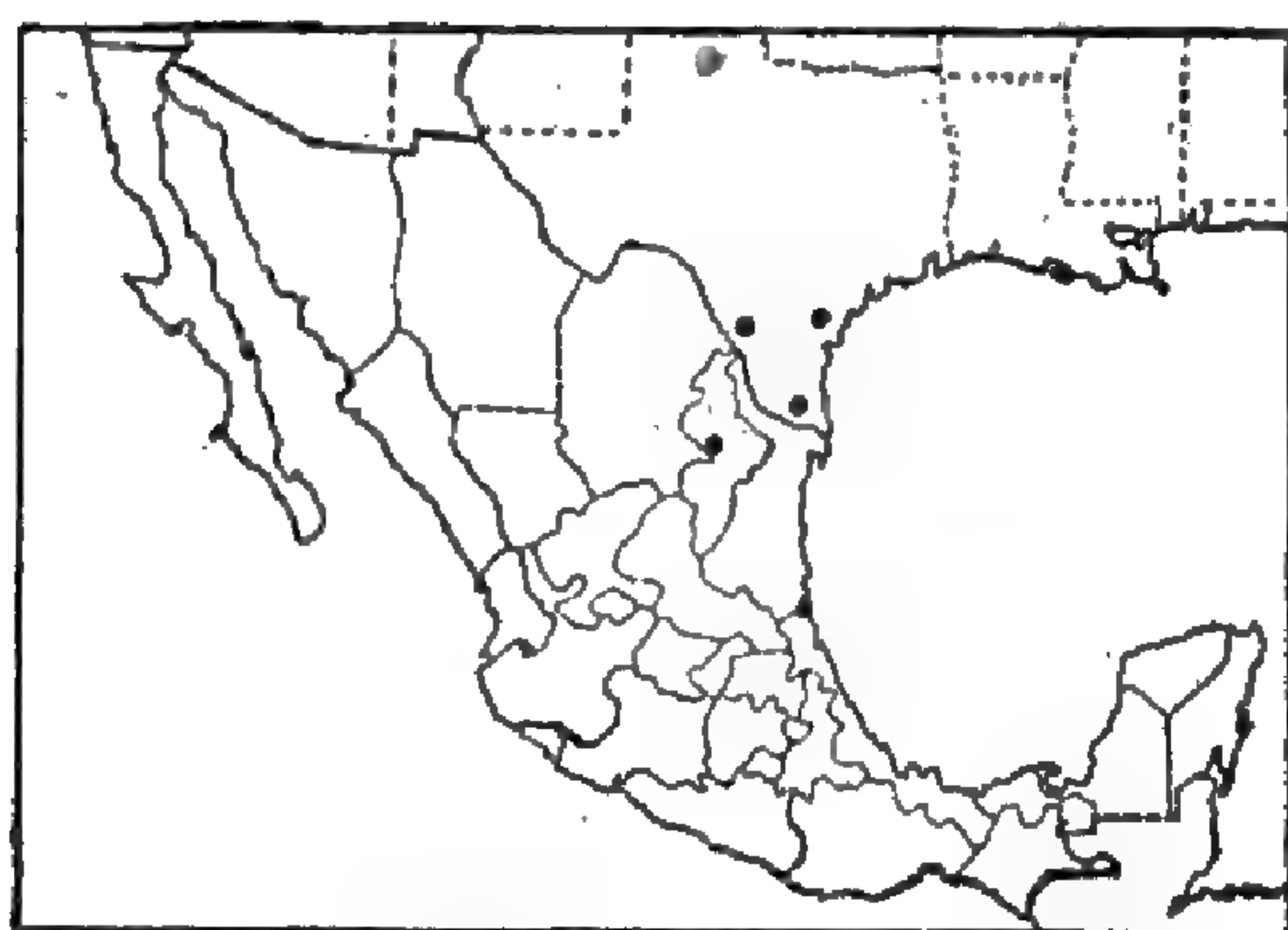


FIG. 40.—Distribution of *P. cayennense*.



## DIFFUSA.

- Second glume and sterile lemma elongated, at least three times as long as the fruit..... 28. *P. capillarioides*.  
 Second glume and sterile lemma not elongated.  
 Culms as much as 1 cm. thick; blades 2 cm. or more wide.. 33. *P. hirsutum*.  
 Culms slender; blades not over 1 cm. wide.  
 Blades 1 to 3 mm. wide; plants spreading or ascending. 29. *P. diffusum*.  
 Blades mostly over 5 mm. wide; plants erect.  
 Spikelets 4 to 4.2 mm. long, the midnerves of glumes and sterile lemma scabrous toward the apex..... 31. *P. lepidulum*.  
 Spikelets usually less than 3.5 mm. long.  
 Blades hirsute on both surfaces (sometimes glabrescent), not at all glaucous..... 32. *P. ghiesbreghtii*.  
 Blades glabrous on both surfaces or with a few hairs on either surface, glaucous above.. 30. *P. hallii*.

FIG. 41.—Distribution of *P. capillarioides*.28. *Panicum capillarioides* Vasey.

*Panicum capillarioides* Vasey in Coulter, Contr. U. S. Nat. Herb. 1: 54. 1890; Contr. U. S. Nat. Herb. 15: 72. 1910.

## DISTRIBUTION.

Prairies, southern Texas and northern Mexico. The type specimen from Texas.

NUEVO LEÓN: Monterrey, *Hitchcock* 5547.

29. *Panicum diffusum* Swartz.

*Panicum diffusum* Swartz, Prodr. Veg. Ind. Occ. 23. 1788; Contr. U. S. Nat. Herb. 15: 72. 1910.

*Panicum guadalupense* Spreng.; Steud. Nom. Bot. ed. 2. 2: 257. 1841. This is a nomen nudum, ascribed to "Spr. hrb. Trin. mpt. Guadal." In the Krug & Urban Herbarium is a specimen of *Panicum diffusum*, collected by "Bertero, S. Domingo," marked in Sprengel's hand "*Panicum guadalupense*."

## DISTRIBUTION.

Banks, cliffs, and savannas, West Indies. The type specimen from Jamaica or Hispaniola.

BAHAMAS: New Providence, *Britton & Brace* 424.

CUBA: Campo Florido, *León* 3449.

Vibora Habana, *León* 2532.

Monte la Noria, *León* 2559.

Bahía Honda, *Wilson* 9443.

Holguin, *Shafer* 1512. La

Gloria, *Shafer* 385. Columbia,

*León* 305 in part, 923b. Ar-

royo Apolo, *León* 190, 923.

Province of Santa Clara, *León*

923c. Santiago de las Vegas,

*Tracy* 9111, *Van Hermann* 1444,

*Baker & Wilson* 511, *Wilson* 1405.

Hanábana, *Wright* in 1865. Tricornia,

*Tracy* 9082. Guanajay, *Palmer & Riley* 802. Isle of Pines, *Curtiss* 384, 494.

Without locality, *Wright* 1540, 3852, 3860 in part, 3877.

FIG. 42.—Distribution of *P. diffusum*.



JAMAICA: Ewarton to Linstead, *Hitchcock* 9463.

SANTO DOMINGO: Without locality, *Wright, Parry & Brummel* 627. Azua, *Rose, Fitch & Russell* 4410.

PORTO RICO: Quebradillas, *Chase* 6567, 6577. Joyuda, *Chase* 6308.

DANISH WEST INDIES: St. Thomas, *Eggers* in 1882.

LEEWARD ISLANDS: Antigua, *Wulfschlaegel* 64. Guadeloupe, *Duss* 3177, 3181 (K. U. Herb.). St. Bartholomew, *Goës* (K. U. Herb.).

WINDWARD ISLANDS: Martinique, *Duss* 536, *Hahn* 1232.

### 30. *Panicum hallii* Vasey.

*Panicum hallii* Vasey, Bull. Torrey Club 11: 64. 1884; Contr. U. S. Nat. Herb. 15: 74. 1910.

#### DISTRIBUTION.

Dry prairie, rocky and gravelly hills and canyons, and in irrigated fields, Texas to Arizona and south to central Mexico. The type specimen from Texas.

CHIHUAHUA: Santa Eulalia Mountains, *Pringle* 376.

DURANGO: Without locality, *Palmer* 525 in 1896.

COAHUILA: Monclova, *Palmer* 1338 in 1880. Saltillo, *Hitchcock* 5605.

NUEVO LEÓN: Monterrey, *Hitchcock* 5537.

TAMAULIPAS: Victoria, *Palmer* 554 in 1907.

SAN LUIS POTOSÍ: Las Canoas, *Hitchcock* 5756. Cárdenas, *Hitchcock* 5719½.

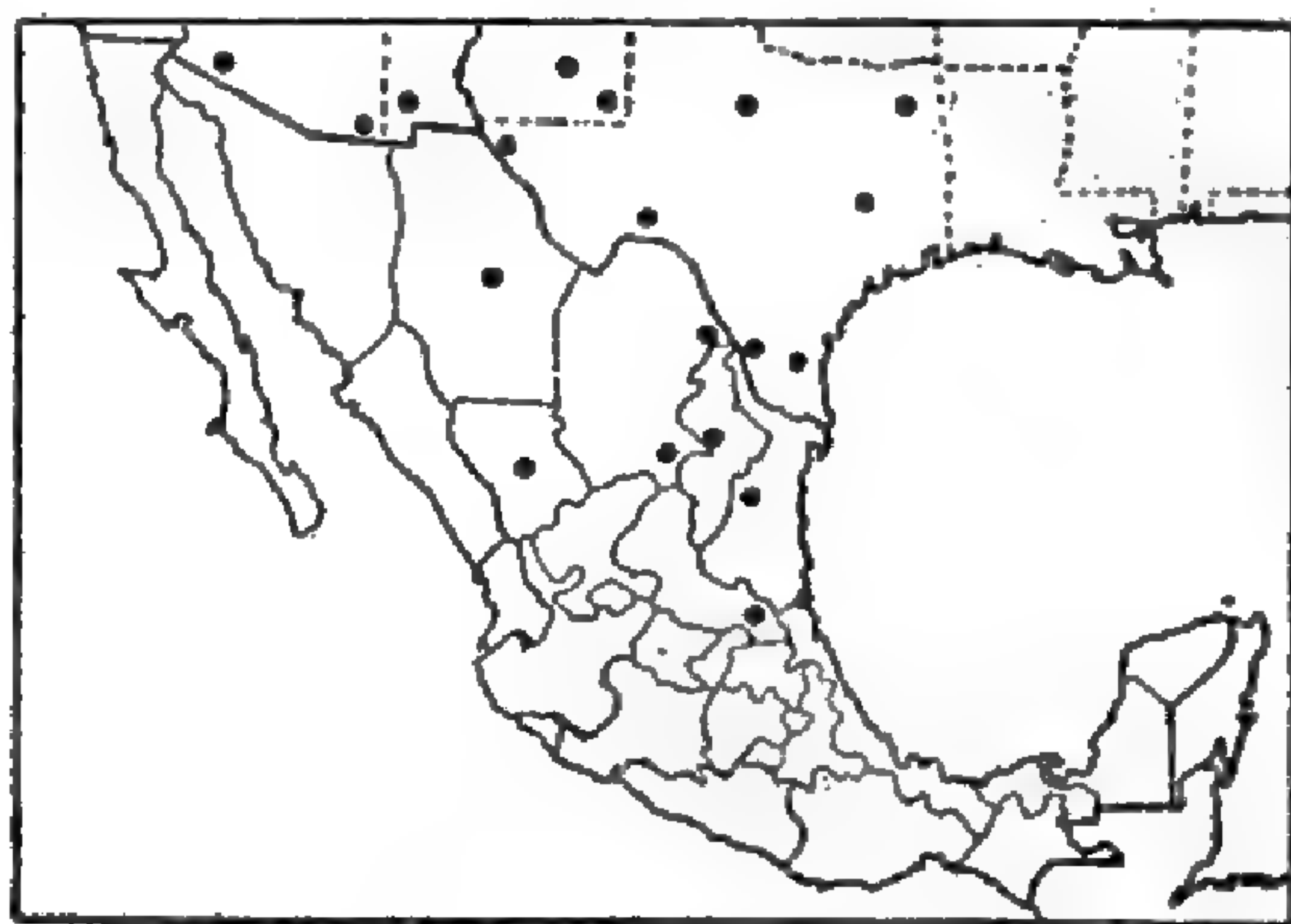


FIG. 43.—Distribution of *P. hallii*.

### 31. *Panicum lepidulum* Hitchc. & Chase.

*Panicum lepidulum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 75. 1910.

#### DISTRIBUTION.

Rocky hills and moist banks, Mexico to Panama. The type specimen from Chihuahua.

CHIHUAHUA: Chihuahua, *Pringle* 497.

DURANGO: Durango, *Palmer* 525 in 1896, *Hitchcock* 7591. Tobar, *Palmer* 533 in 1906.

ZACATECAS: Zacatecas, *Hitchcock* 7510.

SAN LUIS POTOSÍ: Cárdenas, *Hitchcock* 5719.

JALISCO: San Nicolás, *Hitchcock* 7199. Zapotlán, *Hitchcock* 7238.

QUERÉTARO: San Juan del Río, *Rose, Painter & Rose* 9555.

MÉXICO: Pedregal, Federal District, *Amer. Gr. Nat. Herb.* 35.

PUEBLO: Tehuacán, *Hitchcock* 6063.



FIG. 44.—Distribution of *P. lepidulum*.

GUATEMALA: Guatemala City, *Hitchcock* 9014.

PANAMA: Sabano de Juan Corso, *Pittier* 4526.



**32. *Panicum ghiesbreghtii* Fourn.**

*Panicum ghiesbreghtii* Fourn. Mex. Pl. 2: 29. 1886; Contr. U. S. Nat. Herb. 15: 76. 1910.

## DISTRIBUTION.

Low moist ground, Mexico and West Indies to northern South America. The type specimen from Mexico.

JALISCO: Zapotlán, *Hitchcock* 7117.

VERACRUZ: Córdoba, *Hitchcock* 6418, 6426. Jalapa, *Hitchcock* 6546. Orizaba, *Bourgeau* 2751, *Hitchcock* 6363, *Amer. Gr. Nat. Herb.* 36.

OAXACA: Oaxaca, *Hitchcock* 6143.

YUCATÁN: Izamal, *Gaumer* 2477.

SALVADOR: Acajutla, *Hitchcock* 8993.

NICARAGUA: Corinto, *Hitchcock* 8755. San Juan del Sur, *Hitchcock* 8601. Jinotepe, *Hitchcock* 8687.



FIG. 45.—Distribution of *P. ghiesbreghtii*.

COSTA RICA: San José, *Hitchcock* 8452.

Guanacaste, *Jiménez* 730. Llano

Grande de Puriscal, *Jiménez* 880.

Nuestro Amo, *Jiménez* 530. Salinas

Bay, *Pittier* 2633, *Tonduz* 2858.

PANAMA: South of David, *Hitchcock*

8377. Balboa, *Hitchcock* 7997,

8014. Taboga Island, *Hitchcock*

8065, 8094.

BAHAMAS: Crooked Island, *Brace* 4812.

CUBA: La Soledad, *Eggers* 5406. Herra-

dura, *Tracy* 9068. Santiago de las Vegas, *Tracy* 9116. La Perla, *León* 3783.

El Calvario, *León* 922, 2674. Guayabal, *León* 922b. Without locality,

*Wright* 758. Eastern Cuba, *Wright*. Santiago de Cuba, *León* 3747.

PORTO RICO: Coamo Springs, *Chase* 6547. Cayey, *Chase* 6744. Tabucoa, *Sintenis* 4983.

LEEWARD ISLANDS: Guadeloupe, *Duss* 3184. Antigua, *Wulfschlaegel* 620, 621. (K. U. Herb.).

COLOMBIA: Santa Marta, *Smith* 165.

**33. *Panicum hirsutum* Swartz.**

*Panicum hirsutum* Swartz, Fl. Ind. Occ. 1: 173. 1797; Contr. U. S. Nat. Herb. 15: 77. 1910.

*Panicum elatum* Willd.; Steud. Nom. Bot. ed. 2. 2: 256. 1841. In the Willdenow Herbarium this unpublished name is written on a Humboldt collection from "America merid."

The sheaths, especially the lower, of this robust species are hirsute with spreading stiff hairs that cause mechanical irritation to the skin. The panicles are at first compact, with ascending branches, but become diffuse at maturity, the branches finally widely spreading.

## DISTRIBUTION.

Open moist soil, West Indies and central Mexico to northern South America. The type specimen from Jamaica.

COLIMA: Manzanillo, *Hitchcock* 7031.

OAXACA: San Antonio, *Pringle* 5573.

COSTA RICA: Port Limon, *Hitchcock* 8435. Along Bananita River, *Pittier* 3634. Zent Farm, *Pittier* in 1904, *Tonduz* 266. Puerto Viejo, *Biolley* 7467.



PANAMA: Between Bohío and Frijoles, *Hitchcock* 8397. Near Bohío, *Hitchcock* 8392. Tabernilla, *Hitchcock* 8382. Gorgona, *Amer. Gr. Nat. Herb.* 37. Pedro Miguel, *Hitchcock* 7957. Puerto Obaldía, *Pittier* 4374. Culebra, *Pittier* 3441.

CUBA: Matanzas, *Wright* in 1865. Guantánamo, *León* 3913.

LEEWARD ISLANDS: Guadeloupe, *Duss* 3917.

WINDWARD ISLANDS: Martinique, *Duss* 768 (K. U. Herb.).

TRINIDAD: St. Margaritas, *Broadway* 2629. "Burke's pasture," *Bot. Gard. Herb.* 2295.

VENEZUELA: Río Grande del Tuy, Paparo, *Pittier* 6332. Bobures, *Jahn* 353, 355.

COLOMBIA: Santa Marta, *Smith* 164.



FIG. 46.—Distribution of *P. hirsutum*.

MAXIMA.

- Culms with a cormlike base.
- Blades mostly over 5 mm. wide; culms more than 1 meter high.....36. *P. bulbosum*.
- Blades less than 5 mm. wide; culms rarely as much as 1 meter high.....36a. *P. bulbosum sciaphilum*.
- Culms from a creeping rootstock, not cormlike at base.
- Nodes hirsute; ligules 4 to 6 mm. long; fruit strongly rugose....34. *P. maximum*.
- Nodes glabrous; ligules 2 mm. long; fruit very obscurely rugose.....35. *P. plenum*.

34. *Panicum maximum* Jacq.

*Panicum maximum* Jacq. Coll. Bot. 1: 76. 1786; Contr. U. S. Nat. Herb. 15: 78. 1910.

DISTRIBUTION.

Open ground, at low altitudes, escaped from cultivation, southern Florida through Mexico and West Indies to South America, a native of Africa and now widespread in the warmer parts of the Old World. Type locality, Guadeloupe.

SINALOA: Mazatlán, *Rose, Standley & Russell* 14121.

COLIMA: Paso del Río, *Emrick* 3.

VERACRUZ: Córdoba, *Hitchcock* 6410, *Finck* 8, *Kerber* 48. Jalapa, *Hitchcock* 6621. Huitamalco, *Liebmann* 425 in part. Veracruz, *Hitchcock* 6562. San Francisco, *Smith* 1409. Zacuapán, *Purpus* 3774.



FIG. 47.—Distribution of *P. maximum*.

YUCATÁN: Izamal, *Gaumer* 719.

BRITISH HONDURAS: Manatee Lagoon, *Peck* 195 (Gray Herb.).

GUATEMALA: Escuintla, *Smith* 2705, 2706, *Hitchcock* 9001. Morales, *Kellerman* 6267. Gualán, *Deam* 6268. Finca Sepacuité, Alta Verapaz, *Cook & Griggs* 579.

HONDURAS: Puerto Cortez, *Kellerman* 4725.

SALVADOR: San Salvador, *Velasco* 2. Izalco, *Pittier* 1960. Without locality, *Renon* 293.



NICARAGUA: Corinto, *Hitchcock* 8762.

COSTA RICA: Zent Farm, *Pittier* in 1904. Boca Banana, *Tonduz* 9114. San José, *Pittier* 9050. Nuestro Amo, *Pittier* 2034, 16662. Alajuelita, *Tonduz* 2995.

PANAMA: Taboga Island, *Hitchcock* 8080. Caña, *Williams* 779. Culebra, *Pittier* 2088, 4806, *Amer. Gr. Nat. Herb.* 38.

BERMUDA: North Shore Road, *Brown & Britton* 20, *Harshberger* in 1905.

BAHAMAS: Nassau, *Curtiss* 124. Eleuthera, *Geogr. Soc. Baltimore* 338.

CUBA: Herradura, *Hitchcock* 156. Guines, *León* 427, *Liebmann* 445. Santiago de las Vegas, *Baker* 32, *Wilson* 438, *Hitchcock* 157. Santiago de Cuba, *León* 915, *Pollard & Palmer* 283. Guayabal, *León* 921. Marianao, *León* 957. Guanajay, *Palmer & Riley* 816. San Diego de los Baños, *Palmer & Riley* 542, 545. El Guama, *Palmer & Riley* 178. Pinar del Río, *Palmer & Riley* 377. Sierra de Anafe, *León* 2871.

JAMAICA: Port Antonio, *Fredholm* 3319. Kingston, *Hitchcock* 9256, and in 1890. Gordon Town, *Hart* 797. Hope Gardens, *Harris* 11249.

HAITI: Gonaïves, *Buch* 468 (K. U. Herb.).

SANTO DOMINGO: Azua, *Rose, Fitch & Russell* 3949. San Pedro de Macoris, *Rose, Fitch & Russell* 4172.

PORTO RICO: Guanica, *Sintenis* 3366. Mayaguez, *Sintenis* 51, *Chase* 6256. Cayey, *Sintenis* 2468. Aibonito, *Chase* 6332. Sobrante, *Eggers* 1226. Martin Peña, *Heller* 377. Vieques, *Chase* 6669. Mona, *Hess* 449.

DANISH WEST INDIES: St. Croix, *Ricksecker* 200, 413. St. Thomas, *Millspaugh* 454, *Eggers* in 1887, *Rose* 3184.

LEEWARD ISLANDS: Antigua, *Wulfschlaegel* 623b, *Rose, Fitch & Russell* 3452. Dominica, *Jones* 10. Guadeloupe, *Duss* 3186. St. Bartholomew, *Goës* (K. U. Herb.). Saba, *Boldingh* 1580, *Suringar* in 1885 (both in K. U. Herb.).

WINDWARD ISLANDS: Martinique, *Duss* 1288. Barbados, *Dash* 259. Grenada, *Broadway* in 1905. St. Vincent, *Smith & Smith* 288 (K. U. Herb.).

TRINIDAD: Four Roads, *Hitchcock* 10049.

TOBAGO: Scarborough, *Broadway* 4081. Plymouth, *Hitchcock* 10239.

VENEZUELA: Caracas, *Pittier* 6163. Around Dos Caminos and Los Chorros, *Pittier* 5917. Río Grande del Tuy, *Pittier* 6327. Island of Margarita, *Miller & Johnston* 177.

COLOMBIA: Santa Marta, *Smith* 2153. Cartagena, *Hitchcock* 9917. Río Frío, *Pittier* 1617.

### 35. *Panicum plenum* Hitchc. & Chase.

*Panicum plenum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 80. 1910.

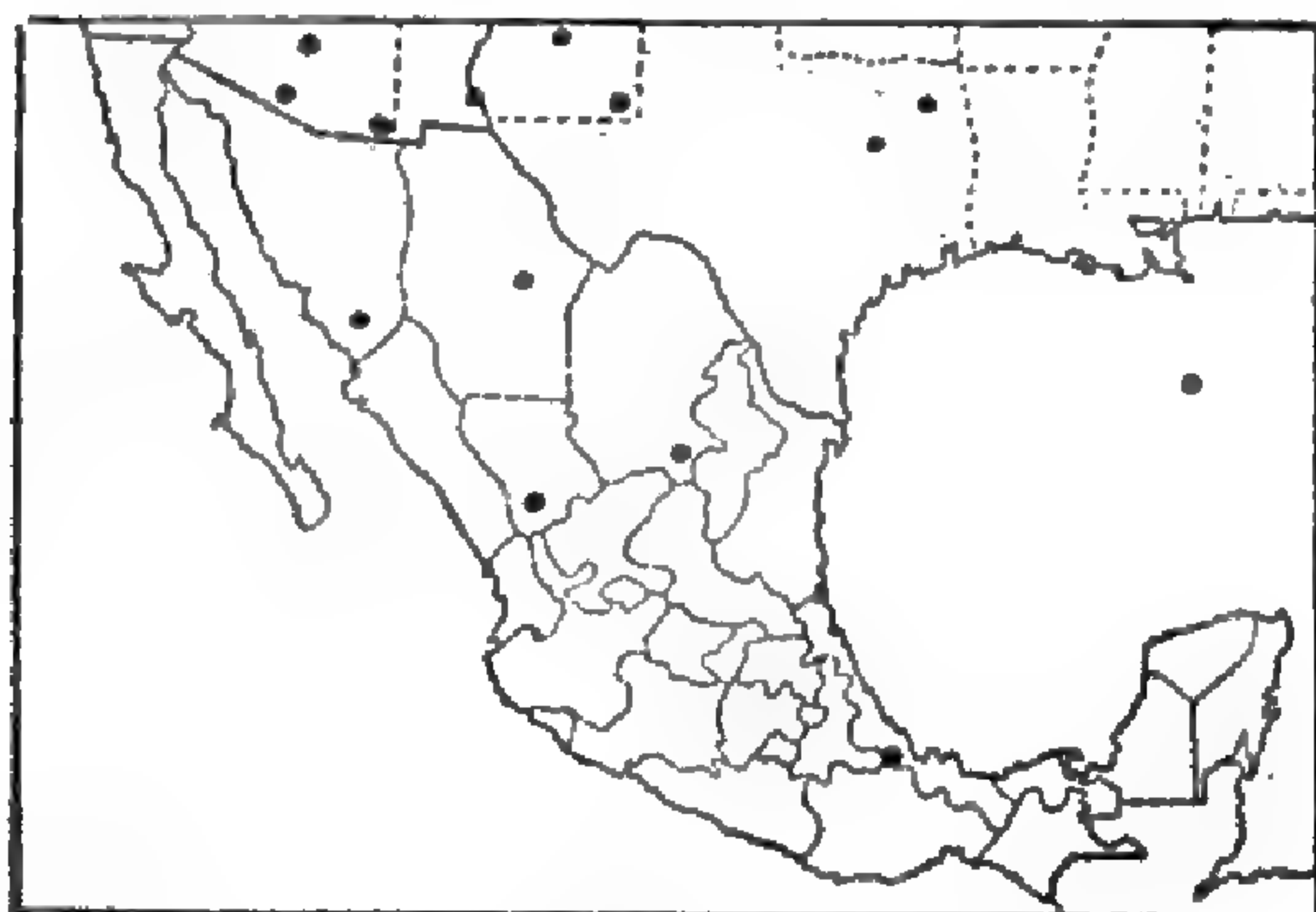


FIG. 48.—Distribution of *P. plenum*.

#### DISTRIBUTION

Moist places in rocky hills and canyons, southwestern United States to central Mexico. The type specimen from New Mexico.

SONORA: Las Cuevas, *Hartman* 170.

CHIHUAHUA: Santa Eulalia Plains, *Wilkinson* in 1885. Chihuahua, *Hitchcock* 7772.

DURANGO: Durango, *Palmer* 741 in 1896.

COAHUILA: Saltillo, *Hitchcock* 5609. Jaral, *Schumann* 1733.

VERACRUZ: Orizaba, *Botteri* 160.



**36. *Panicum bulbosum* H. B. K.**

*Panicum bulbosum* H. B. K. Nov. Gen. & Sp. 1: 99. 1816; Contr. U. S. Nat. Herb. 15: 81. 1910.

## DISTRIBUTION.

Moist places in canyons and valleys, southwestern United States to southern Mexico. The type specimen from central Mexico.

CHIHUAHUA: Candelaria, *Stearns* 266. Chihuahua, *Pringle* 377. Colonia García, *Nelson* 6187, *Townsend & Barber* 221. Sierra Madre, *Nelson* 6301. Mount Mohinora, *Nelson* 4901. Cañon de San Diego, *Hartman* 790.

DURANGO: Otínapa, *Palmer* 340 in 1906. Durango, *Palmer* 525a in 1896. Without locality, *Palmer* 741 in 1896.

TEPIC: Between Aguacate and Dolores, *Rose* 3361. Between Pedro Paulo and San Blasito, *Rose* 1999.

SAN LUIS POTOSÍ: San Luis Potosí, *Parry & Palmer* 958. Las Canoas, *Hitchcock* 5754.

JALISCO: Road between Mexquitic and Monte Escobedo, *Rose* 2609. Nevada de Colima, *Hitchcock* 7150. Río Blanco, *Palmer* 207 in 1886.

MICHOACÁN: Morelia, *Arsène* in 1909.

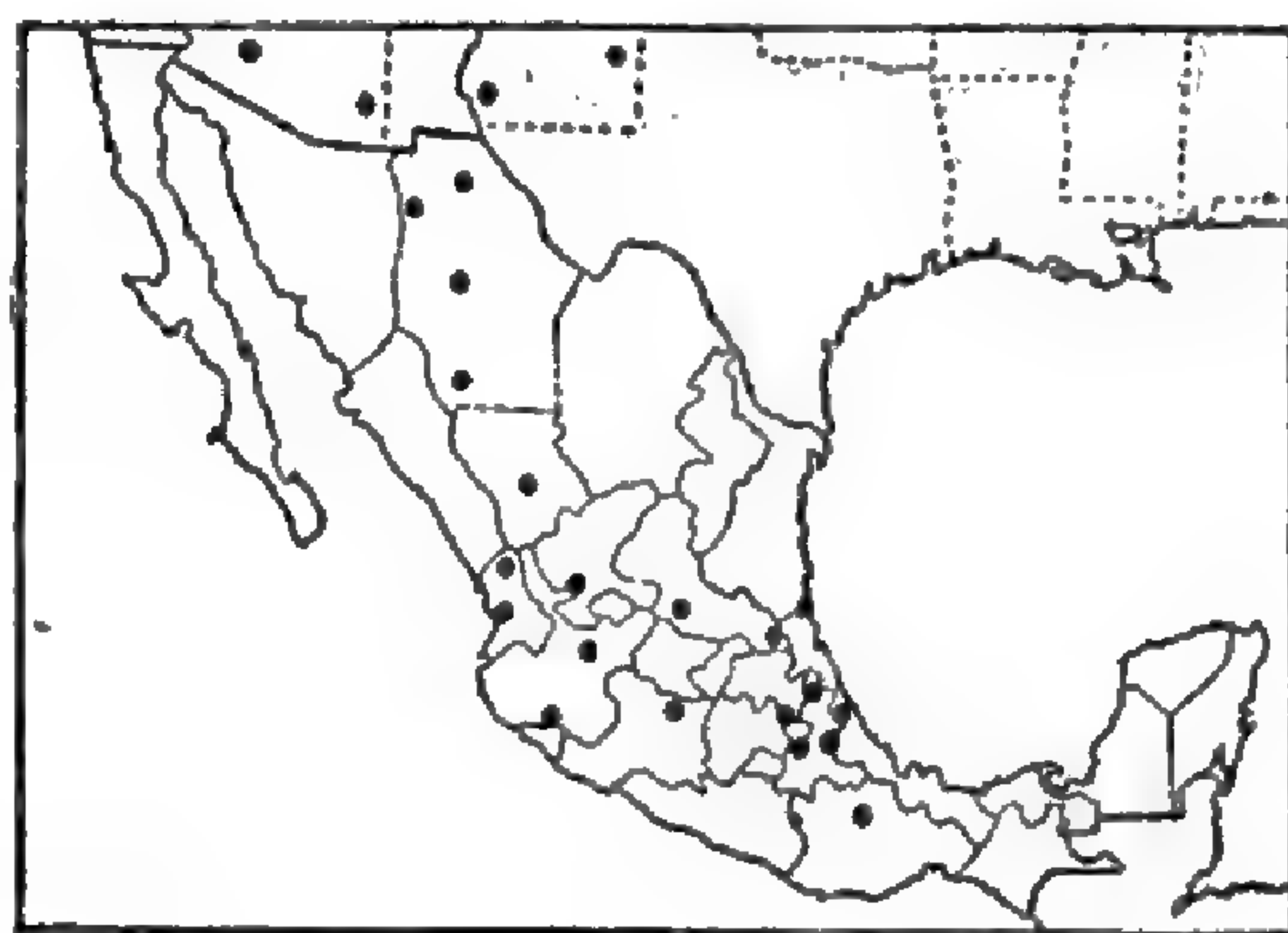
MÉXICO: Federal District, *Orcutt* 3518,

*Hitchcock* 5932, 5941, 7835, *Amer. Gr. Nat. Herb.* 39, *Holway* 12, *Bourgeau* 235, *Rose & Painter* 9249, *Pringle* 9575, 6418. Valley of Toluca, *Pringle* 5207.

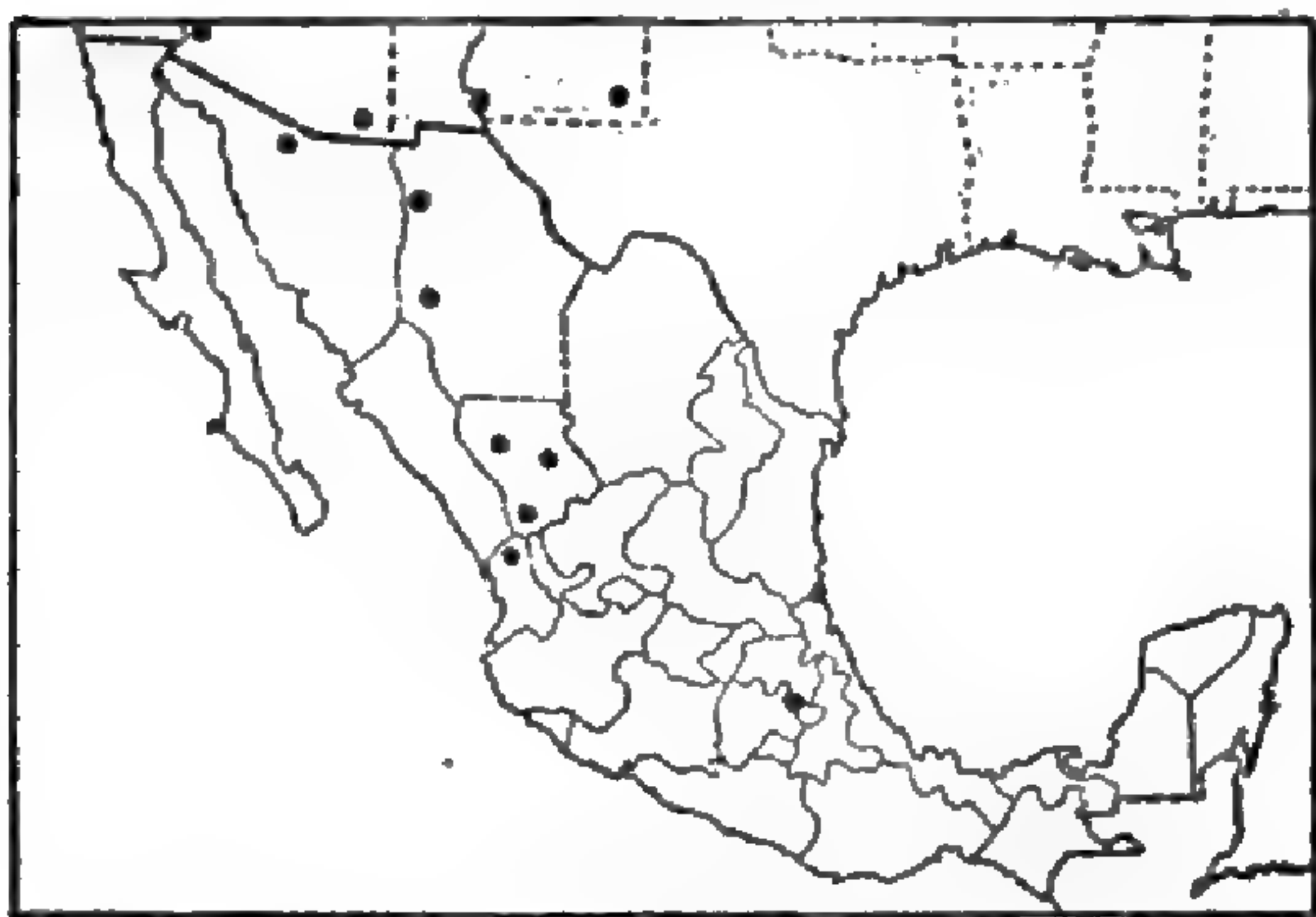
PUEBLA: Chinantla, *Liebmann* 441, 442. Cerro de Baxtla, *Purpus* 2908. Esperanza, *Seaton* 317. Bords de l'Atoyac, *Nicolas* in 1909.

VERACRUZ: Borrego, *Bourgeau* 2754. Orizaba, *Hitchcock* 6384.

OAXACA: Oaxaca, *Nelson* 1374. Cerro de San Felipe, *Conzatti & González* 243.

FIG. 49.—Distribution of *P. bulbosum*.**36a. *Panicum bulbosum sciaphilum* (Rupr.) Hitchc. & Chase.**

*Panicum bulbosum sciaphilum* (Rupr.) Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 83. 1910.

FIG. 50.—Distribution of *P. bulbosum sciaphilum*.

## DISTRIBUTION.

Gravelly river banks, southwestern United States to central Mexico. The type specimen from central Mexico.

SONORA: Nogales to Cocospora Ranch, *Griffiths* 6785½.

CHIHUAHUA: Cusihuiachic, *Pringle* 1406. Sierra Madre, *Nelson* 6298. Sánchez, *Hitchcock* 7666.

DURANGO: Tejamén, *Palmer* 469 in 1906.

Otínapa, *Palmer* 348, 349, and 554

in 1906. Santiago Papasquiario, *Palmer* 467 in 1896. Iron Mountain, *Hitchcock* 7634.

TEPIC: Between Dolores and Santa Gertrudis, *Rose* 2053.

MÉXICO: Barranca de Río Aqueducto, *Rose & Painter* 8634.



## VIRGATA.

Perennials, mostly with stout rootstocks, one species, *P. ichnanthoides* found to be without rootstocks.

Creeping rootstocks wanting..... 40. *P. ichnanthoides*.

Creeping rootstocks present.

Spikelets not over 2.5 mm. long; first glume less than half the length of the spikelet.

Panicles loosely flowered; first glume truncate, about one-fifth the length of the spikelet..... 37. *P. repens*.

Panicles rather densely flowered; first glume triangular, about one-third the length of the spikelet..... 38. *P. gouini*.

Spikelets 3 to 7 mm. long (sometimes less than 3 mm. in *P. virgatum cubense*); first glume more than half the length of the spikelet.

Culms decumbent or creeping at base.

Spikelets 3.2 to 4 mm. long..... 41. *P. altum*.

Spikelets 6 to 8 mm. long..... 42. *P. havardii*.

Culms erect.

Panicles elongate, strongly contracted; seacoast plants..... 43. *P. amarulum*.

Panicles diffuse or only slightly contracted; plants sometimes of salt marshes but not littoral.

Panicles open, loosely-flowered; spikelets 3.5 to 5 mm. long, beaked; first glume two-thirds the length of the spikelet or more, acuminate-pointed..... 39. *P. virgatum*.

Panicles somewhat contracted; spikelets not over 3.2 mm. long, not beaked; first glume about half the length of the spikelet, not acuminate..... 39a. *P. virgatum cubense*.

37. *Panicum repens* L.

*Panicum repens* L. Sp. Pl. ed. 2. 87. 1762; Contr. U. S. Nat. Herb. 15: 85. 1910.



FIG. 51.—Distribution of *P. repens*.

## DISTRIBUTION.

Sea beaches, warmer regions of both hemispheres; in America from Alabama to Brazil. Originally described from the Old World.

NICARAGUA: Without locality, Flint 8.

CUBA: Arroyo Apol6, Le6n 296, 563. Habana, Le6n in 1909.



**38. *Panicum gouini* Fourn.**

*Panicum gouini* Fourn. Mex. Pl. 2: 28. 1886; Contr. U. S. Nat. Herb. 15: 86. 1910.

**DISTRIBUTION.**

Sea beaches along the Gulf of Mexico. The type specimen from Veracruz.

VERACRUZ: Veracruz, *Pringle* 5569, *Amer. Gr. Nat. Herb.* 40, *Müller* 2177. Antigua, *Liebmann* 450. Coatzacoalcas, *Smith* 913.



FIG. 52.—Distribution of *P. gouini*.

**39. *Panicum virgatum* L.**

*Panicum virgatum* L. Sp. Pl. 59. 1753; Contr. U. S. Nat. Herb. 15: 87. 1910.

**DISTRIBUTION.**

Prairies and open woods, eastern and central United States, south to northern South America. The type specimen from Virginia.

JALISCO: Río Blanco, *Palmer* 207 and 510 in 1886.

CHIAPAS: Between San Ricardo and Ocozucuantla, *Nelson* 2975.

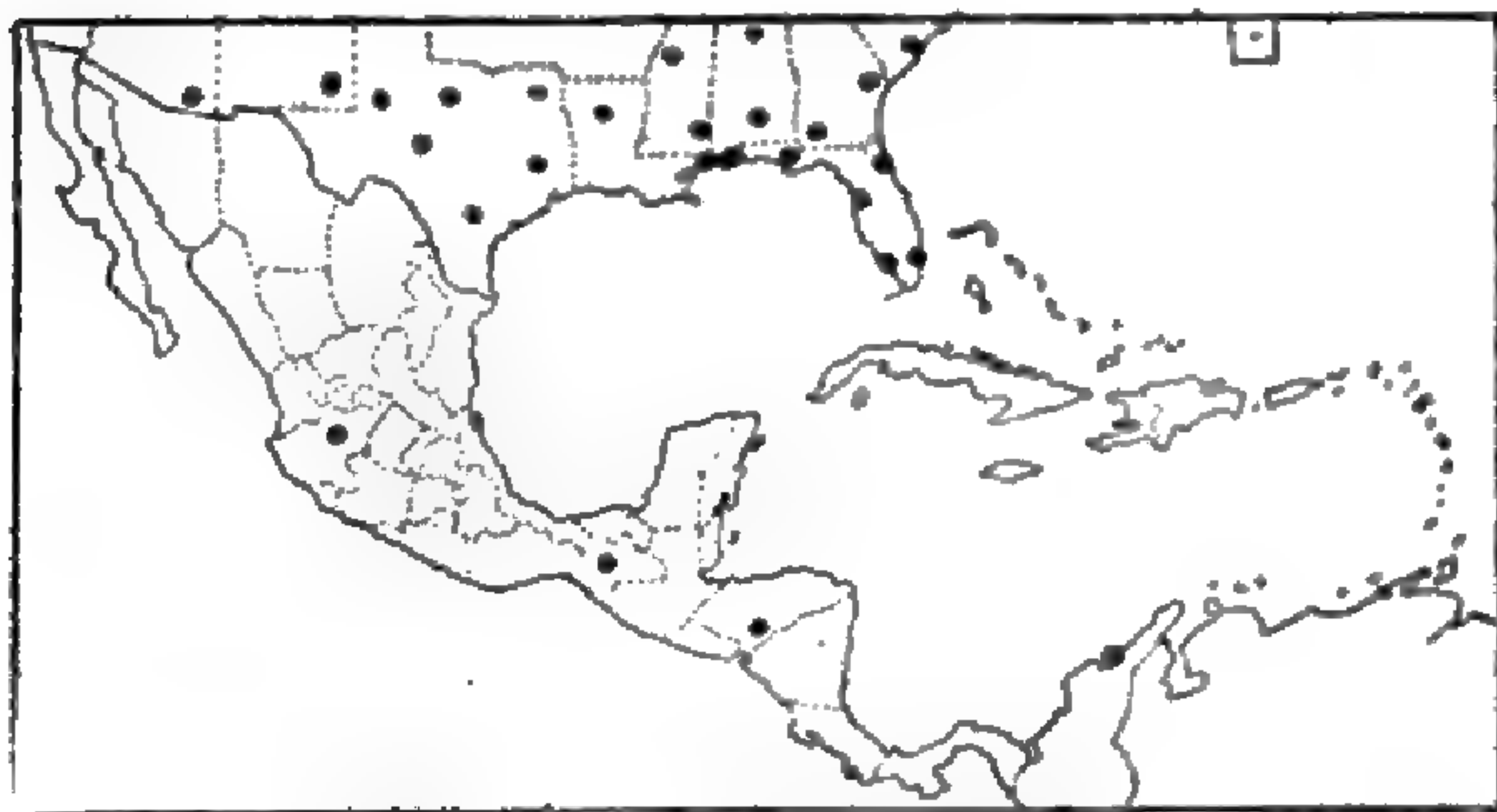


FIG. 53.—Distribution of *P. virgatum*.

HONDURAS: Santa Anna, *Thieme* 532.

VENEZUELA: Alto Apure, *Jahn* 198.

COLOMBIA: Santa Marta, *Smith* 166.

**39a. *Panicum virgatum cubense* Griseb.**

*Panicum virgatum cubense* Griseb. Cat. Pl. Cub. 233. 1866; Contr. U. S. Nat. Herb. 15: 92. 1910.

**DISTRIBUTION.**

Pine woods, Atlantic Coastal Plain, Bermuda and Cuba. The type specimen from Cuba.

BERMUDA: *Stone* in 1888 (*Acad. Phil. Herb.*).

CUBA: Batabanó, *Hitchcock* 153, *Palmer & Riley* 1134. Be-

tween Laguna Jovero and Laguna Herradura, *Shafer* 10927. Without locality, *Wright* 3873.



FIG. 54.—Distribution of *P. virgatum cubense*.



40. *Panicum ichnanthoides* Fourn.

*Panicum ichnanthoides* Fourn. Mex. Pl. 2: 30. 1886; Contr. U. S. Nat. Herb. 15: 88. 1910, as synonym under *P. virgatum*. The type specimen, Müller 2002, in the herbarium of the Botanical Garden in St. Petersburg, was collected at Orizaba.

*Panicum buchingeri* Fourn. Mex. Pl. 2: 30. 1886. "Orizaba (Thomas in herb. Buchinger)." Contr. U. S. Nat. Herb. 15: 329. 1910. We have been unable to find the type. From the description it is evident that the species is allied to *P. virgatum* L., while the locality would indicate *P. ichnanthoides*.

## DESCRIPTION.

Plants in large clumps with knotted crowns, without creeping rootstocks; culms 1.5 to 2 meters high, erect or decumbent at base, smooth, firm, and hard, more or less glaucous about the nodes; sheaths shorter than the internodes, pubescent on the overlapping margin toward the apex, otherwise glabrous; ligule about 3 mm. long, membranaceous-ciliate; blades elongate, mostly 8 to 15 mm. wide, flat except at the narrowed and usually inrolled base, scabrous on the margins, villous on the upper surface near the base, otherwise glabrous; panicle 20 to 40 cm. long, one-fourth to one-third as wide, the long slender branches ascending; spikelets 3.5 to 4.2 mm. long, about 1.5 mm. wide, similar to those of *P. virgatum*.

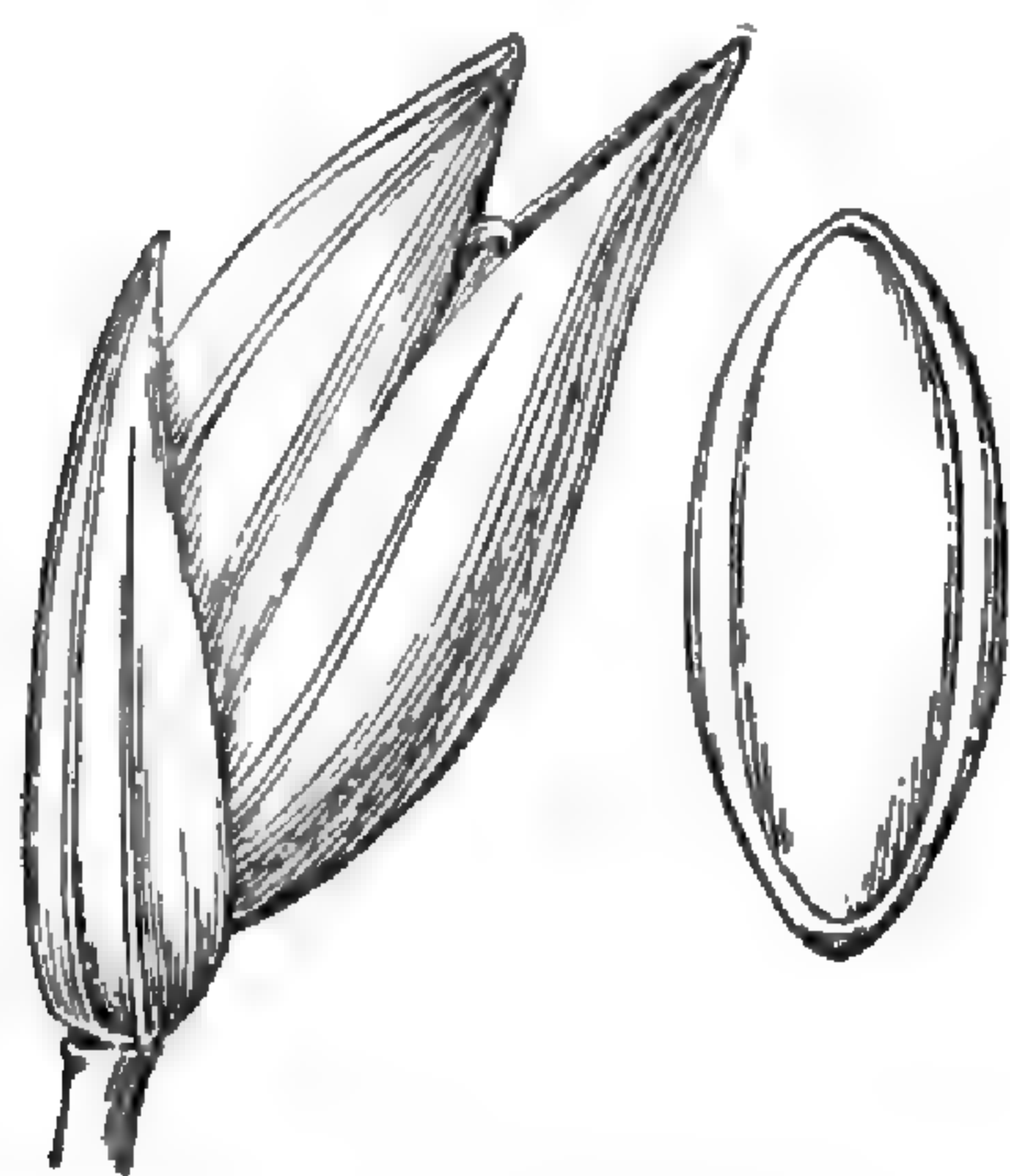


FIG. 55.—*P. ichnanthoides*.  
From type specimen.

This species is closely allied to *P. virgatum* L., from which it differs in the absence of creeping rootstocks and in the narrow panicle. The patch of plants from which was collected Hitchcock's no. 6364 is probably

that from which Botteri, Müller, and Thomas obtained their specimens. This patch lies along a trail leading up a prominent hill at the western edge of the city of Orizaba, a locality likely to be visited by all botanists collecting in that region.

## DISTRIBUTION.

Open rocky hillsides, southern Mexico, British Honduras, and Nicaragua.

PUEBLA: Tehuacán, Endlich 1938.

VERACRUZ: Orizaba, Botteri 648, Hitchcock 6364, Müller 2002.

BRITISH HONDURAS: Manatee Lagoon, Peck 73 (Gray Herb.).

NICARAGUA: Jinotepe, Hitchcock 8685.



FIG. 56.—Distribution of *P. ichnanthoides*.

41. *Panicum altum* sp. nov.

## DESCRIPTION.

Plants perennial, in tangled masses, the culms decumbent and straggling at base stout, reedlike, as much as 6 mm. in diameter, ascending to a height of 2 to 4 meters, smooth and glaucous, simple or with extravaginal, mostly erect, sterile branches from the swollen nodes; sheaths smooth; ligule a short membrane less than 1 mm. long, the ciliate fringe once or twice as long; blades flat, firm, not greatly elongated, mostly 30 to 45 cm. long, 8 to 15 mm. wide, smooth except the scabrous margins, panicles rather more densely flowered than in *P. virgatum*, 20 to 30 cm. long, narrowly ovoid in out-



line, open, the slender scabrous branches ascending and spreading, fascicled, some naked at base, with short branchlets intermixed; spikelets rather short-pediceled, 3.2 to 4 mm. long, about 1.2 mm. wide, turgid, glabrous, the glumes and sterile lemma strongly nerved, pointed, somewhat keeled, usually widely gaping, the first glume about two-thirds the length of the spikelet, the second glume and sterile lemma exceeding the fruit, subequal; fruit 2 to 2.2 mm. long, 1 mm. wide, elliptic.

Type in the U. S. National Herbarium, no. 693326, collected in moist sandy soil, near sea beach on Point Chamé, Province of Panama, September 18, 1911, by A. S. Hitchcock (no. 8167).

In the inflorescence this species closely resembles *P. virgatum*, but in habit it differs distinctly. It grows in masses like large reeds such as *Phragmites* but is straggling and much tangled at base.

#### DISTRIBUTION.

Sandy marshes or flats near the seacoast, British Honduras to Trinidad.

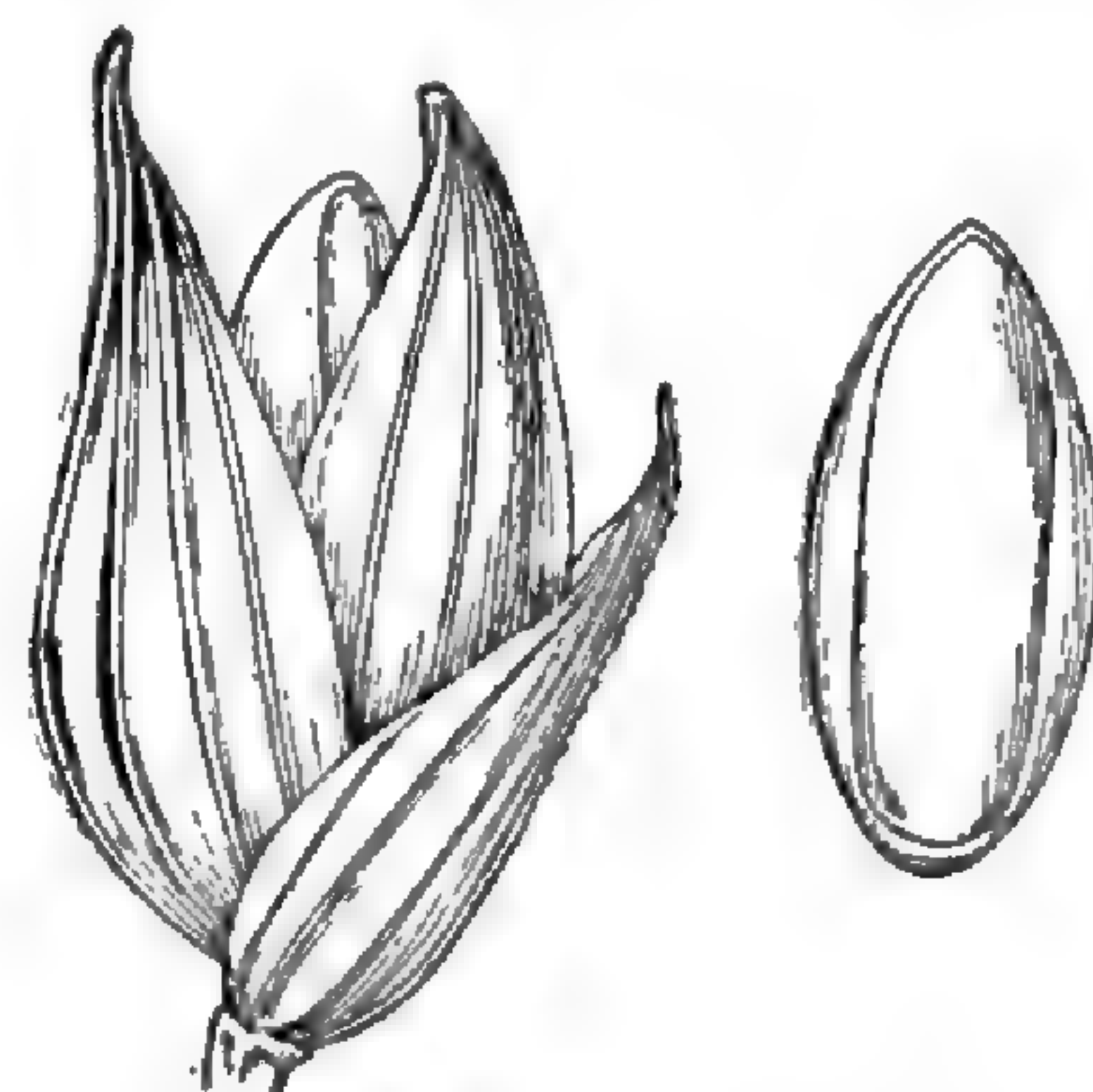


FIG. 57.—*P. altum*. From type specimen.



FIG. 58.—Distribution of *P. altum*.

BRITISH HONDURAS: Manatee Lagoon, Peck 123 (Gray Herb.).

COSTA RICA: Buenos Aires, Tonduz 3619.

PANAMA: Point Chamé, Hitchcock 8167.

TRINIDAD: Near Port of Spain, Hitchcock 10053. Icacos, Hitchcock 10154. Three miles south of Cedros, Hitchcock 10159.

TOBAGO: Plymouth, Hitchcock 10233. Pigeon Point, Broadway 3068.

#### 42. *Panicum havardii* Vasey.

*Panicum havardii* Vasey, Bull. Torrey Club 14: 95. 1887; Contr. U. S. Nat. Herb. 15: 93. 1910.

#### DISTRIBUTION.

Arroyos and sand hills, southwestern United States and northern Mexico. The type specimen from Texas.

CHIHUAHUA: Paso del Norte (Juárez), Pringle 1124.



FIG. 59.—Distribution of *P. havardii*.

#### 43. *Panicum amarulum* Hitchc. & Chase.

*Panicum amarulum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 96. 1910.

#### DISTRIBUTION.

Sandy seashores and coast dunes, southeastern United States, Bahamas, and Cuba. The type specimen from Virginia.

BAHAMAS: Great Bahama, Britton & Millspaugh 2739. New Providence, Britton & Brace 307, 493 (all Field Mus. Herb.).

CUBA: Camaguey, Shafer 2735.



FIG. 60.—Distribution of *P. amarulum*.



## TENERA.

- Second glume and sterile lemma exceeding the fruit; spikelets pointed. . . . . 44. *P. tenerum*.  
 Second glume and sterile lemma not exceeding the fruit; spikelets rather blunt.  
 Pedicels bearing long stiff erect hairs at the summit. . . . . 46. *P. caricoides*.  
 Pedicels not hairy.  
 Spikelets attenuate at base, about 2 mm. long; leaves more or less pilose. . . . . 45. *P. stenodoides*.  
 Spikelets not attenuate at base, about 1.5 mm. long; leaves glabrous. . . . . 47. *P. stenodes*.

44. *Panicum tenerum* Beyr.

*Panicum tenerum* Beyr. in Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 1: 341. 1834; Contr. U. S. Nat. Herb. 15: 97. 1910.



FIG. 61.—Distribution of *P. tenerum*.

## DISTRIBUTION.

Margins of sandy swamps and ponds and in wet places in sandy woods, southeastern United States, Cuba, and Porto Rico. The type specimen from Georgia.

CUBA: Herradura, *Hitchcock* 154, *Tracy* 9080. Laguna Jovero, *Shafer* 10750. Laguna Los Indios, *Shafer* 10807. Pinar del Río, *Wright* 3870 in part.

PORTO RICO: Campo Alegre, *Chase* 6617.

45. *Panicum stenodoides* Hubbard.

*Panicum stenodoides* Hubbard, Proc. Amer. Acad. 49: 497. 1913. "Type (in the Gray Herb.) and only specimen seen, low pine ridge, Ycacos Lagoon, March 5, 1907, M. E. Peck, no. 681." A portion of the type in Hubbard's herbarium has been examined.

## DESCRIPTION.

Plants perennial in dense tufts; culms erect, slender and wiry, glabrous or sparsely pilose below the glabrous nodes, 20 to 40 cm. high, producing from the upper nodes slender leafless panicle-bearing branches; sheaths papillose or more or less papillose-pilose, the lowermost bladeless, glabrous, in age fibrous; ligule membranaceous, about 0.3 mm. long; blades erect, flat at base, involute toward the apex, 3 to 8 cm. long, 1 to 2 mm. wide, more or less papillose or papillose-pilose, at least on the upper surface, sometimes glabrous; panicles short-exserted, usually exceeded by the uppermost blade, about 1 cm. long, narrow, bearing 3 to 7 spikelets on appressed scabrous pedicels, rarely a few delicate hairs at the apex of the pedicels; spikelets 2 to 2.1 mm. long, 0.9 mm. wide, turgid, attenuate at base, glabrous; first glume about half as long as the spikelet; second glume and sterile lemma subequal, barely covering the fruit, strongly nerved; fruit 1.7 mm. long, 0.8 mm. wide.

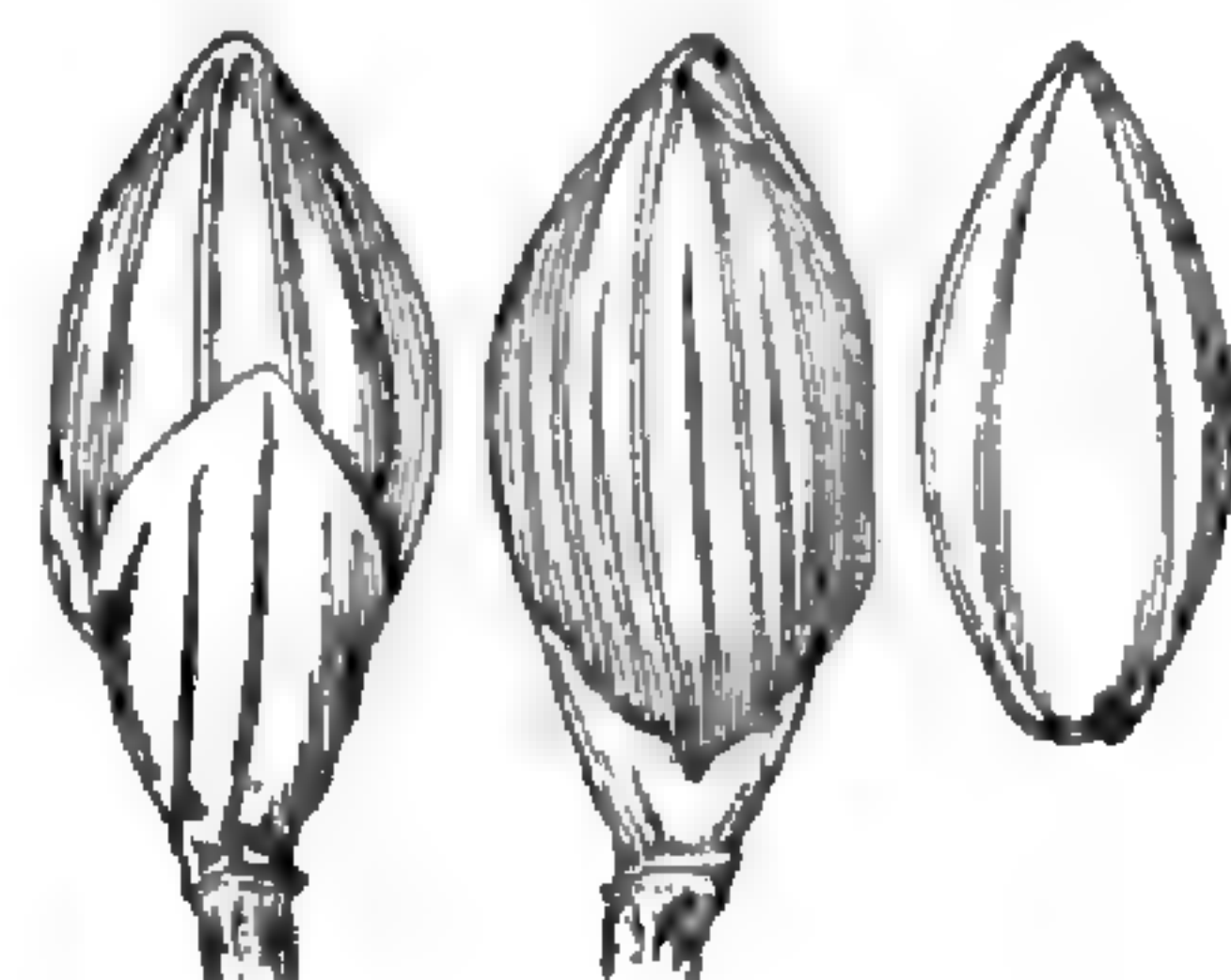


FIG. 62.—*P. stenodoides*. From type specimen.



This species resembles *P. stenodes*, but differs in having larger spikelets and papillose-pilose or at least papillose sheaths. The type specimen and Hitchcock's no. 8147 are conspicuously pilose on sheaths and blades, but the other specimens of this little-known species are papillose only or have a few hairs on the upper surface of the blades.

## DISTRIBUTION.

Open grass land and moist savannas, Central America and northern South America.

BRITISH HONDURAS: Ycacos Lagoon, *Peck* 681 (Gray Herb.).

COSTA RICA: Buenos Aires, *Tonduz* 3583.

PANAMA: Chorrera, *Hitchcock* 8147.

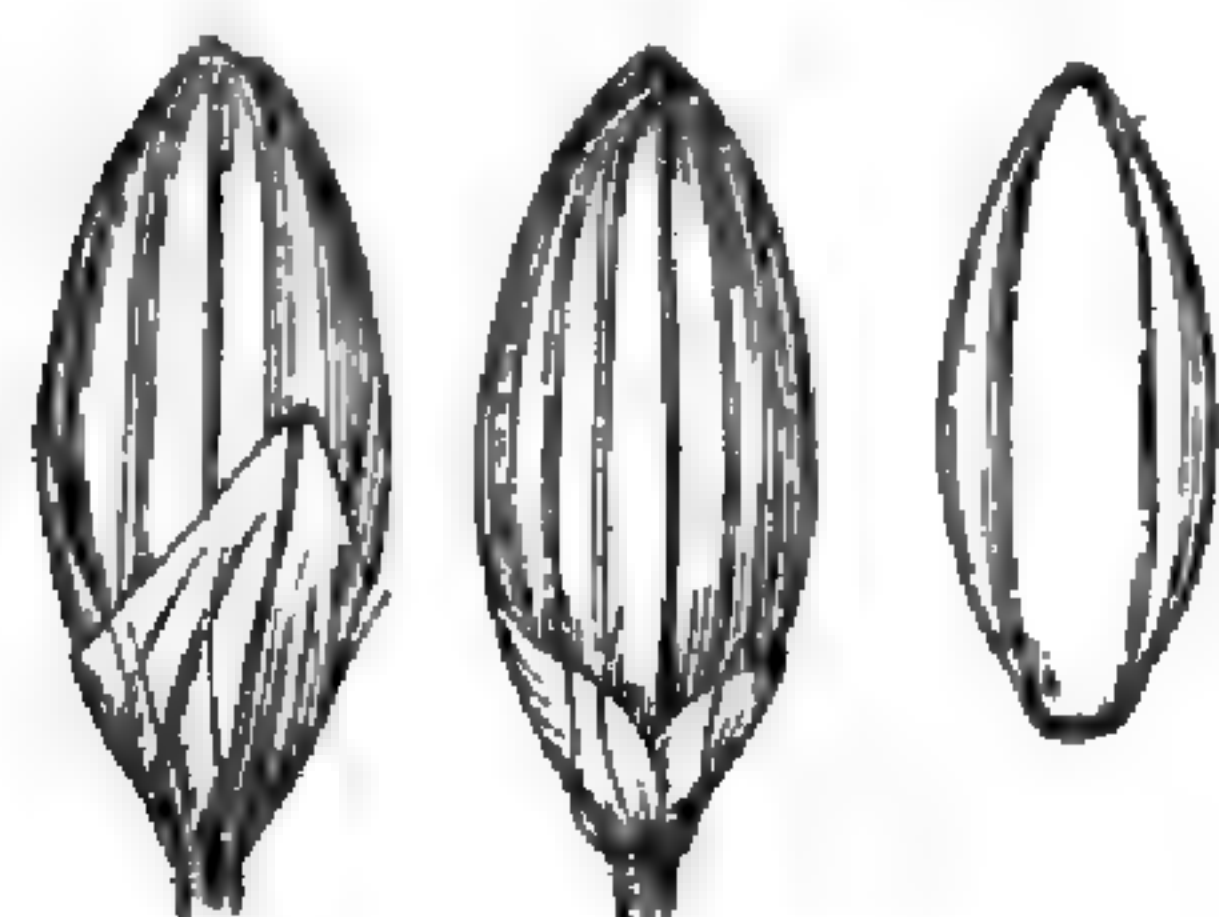
Near Corozal, *Hitchcock* 9207.

TRINIDAD: Piarco Savanna, south of Arouca, *Hitchcock* 10346.

FIG. 63.—Distribution of *P. stenodoides*.46. *Panicum caricoides* Nees.

*Panicum caricoides* Nees; Trin. Gram. Pan. 149. 1826. Trinius received the type specimen from Nees, "V. spp. Brazil. (N. ab Esenb.)" Nees<sup>1</sup> afterwards describes the species more fully and gives the original locality as "provincia Paraensi." The type specimen is in the Trinius Herbarium at the St. Petersburg Academy of Science. It is evidently a portion of the specimen at the Munich Herbarium. This specimen, which is the basis of Nees's later description, was collected in Pará by Martius.

*Panicum junciforme* Steud. Syn. Pl. Glum. 1: 82. 1854. Given as a synonym of *P. caricoides*.

FIG. 64.—*P. caricoides*.  
From type specimen.

## DESCRIPTION.

Perennial, in tufts; culms erect, slender, glabrous, stiff and wiry, as much as 90 cm. high; sheaths smooth; ligule membranaceous, lacerate, minute; blades appressed, narrower than the sheath, involute, glabrous, 1 to 5 cm. long, the lower rarely longer; panicles terminal and axillary from the upper sheaths, short-exserted, 1 to 1.5 cm. long, narrow, nearly simple, the later panicles smaller, in fascicles of 2 or 3, at first partially inclosed by the somewhat inflated sheaths, the pedicles bearing long erect white hairs just below the rather crowded spikelets; spikelets 1.5 to 1.8 mm. long, about 0.8 mm. wide, turgid, glabrous; first glume about half as long as the spikelet, subacute; second glume and sterile lemma equal, covering the fruit, strongly nerved; fruit 1.4 to 1.5 mm. long, 0.6 mm. wide.

## DISTRIBUTION.

Wet savannas, Trinidad to Brazil.

TRINIDAD: Aripo Savanna, Cumuto Station, *Hitchcock* 10069.

FIG. 65.—Distribution of *P. caricoides*.

<sup>1</sup>Agrost. Bras. 108. 1829.



47. *Panicum stenodes* Griseb.

*Panicum stenodes* Griseb. Fl. Brit. W. Ind. 547. 1864; Contr. U. S. Nat. Herb. 15: 98. 1910.

FIG. 66.—Distribution of *P. stenodes*.

## DISTRIBUTION.

Borders of ponds and wet savannas, West Indies and Costa Rica to Brazil. The type specimen from Jamaica.

COSTA RICA: Buenos Aires, *Pittier* 10589, *Tonduz* 3583.

CUBA: Herradura, *Hitchcock* 155. Without locality, *Wright* 3871.

JAMAICA: Bull Head Mountain, *Amer. Gr. Nat. Herb.* 46.

SANTO DOMINGO: Without locality, *Wright, Parry & Brummel* 624.

PORTO RICO: Trujillo Alto, *Chase* 6769.

TRINIDAD: Cumuto Station, *Hitchcock* 10069. Piarco Savanna, *Hitchcock* 10347.

## AGROSTOIDIA.

48. *Panicum condensum* Nash.

*Panicum condensum* Nash in Small, Fl. Southeast. U. S. 93. 1903; Contr. U. S. Nat. Herb. 15: 102. 1910.

## DISTRIBUTION.

Swamps and borders of ponds and streams, Pennsylvania to Florida and Texas near the coast, south into Mexico and the West Indies. The type specimen from Florida.

VERACRUZ: Without locality, *Gouin* 10.

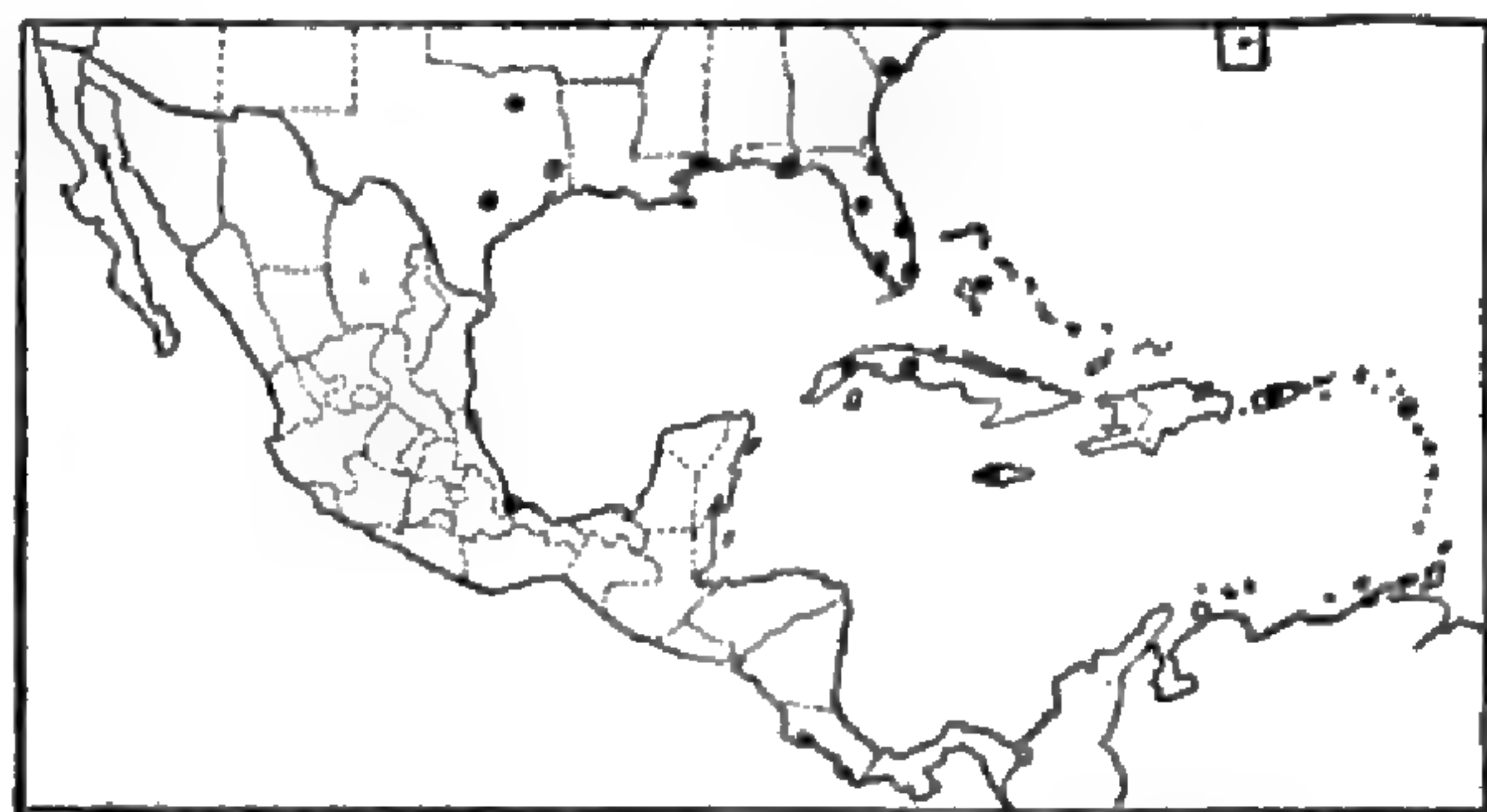
BAHAMAS: Nassau, *Curtiss* 174.

CUBA: Banks of Guanabo River, *León* 4141. Along Gibora carretera north of Holguin, *Shafer* 1438. Hanábana, *Wright* 184 in 1865. Without locality, *Wright* 3862 in part.

JAMAICA: Savanna-la-Mar, *Hitchcock* 9884. Black River, *Amer. Gr. Nat. Herb.* 47.

PORTO RICO: Santurce, *Chase* 6351. Campo Alegre, Laguna del Tortuguero, *Chase* 6802.

LEEWARD ISLANDS: Guadeloupe, *Duss* 3919.

FIG. 67.—Distribution of *P. condensum*.

## LAXA.

All the species are perennial.

Spikelets not expanded at maturity by an enlarged sterile palea, pointed.

Nodes glabrous; spikelets 2.5 mm. long. . . . . 49. *P. longum*.

Nodes densely pubescent; spikelets not over 1.5 mm. long.. 50. *P. polygonatum*.



Spikelets expanded at maturity by the enlarged sterile palea, usually blunt.

Panicle branches not racemose; blades scarcely wider than their sheaths; sterile palea conspicuously enlarged.

Spikelets 3 mm. long, congested; panicles dark purple.. 58. *P. cupreum*.

Spikelets not over 2.4 mm. long; panicles green or pale.

Panicle branches spikelet-bearing or branchlet bearing along the upper half or toward the ends only ..... 57. *P. hians*.

Panicle branches branchlet-bearing throughout their length or nearly so..... 56. *P. exiguiiflorum*.

Panicle branches subracemose, the spikelets secund; blades at least 5 mm. wide; enlarged sterile palea not conspicuous.

Blades narrowed toward the base..... 54. *P. laxum*.

Blades cordate or truncate at base.

Spikelets 2 mm. long; panicle branches erect or nearly so..... 55. *P. stevensianum*.

Spikelets not over 1.6 mm. long, usually less; panicle branches spreading or ascending.

Panicles one-third to half as wide as long; spikelets not conspicuously secund, somewhat irregularly disposed; blades cordate-clasping..... 53. *P. boliviense*.

Panicles rarely one-fourth as wide as long; spikelets conspicuously secund and regularly disposed.

Culms as much as 2 meters long; panicles 25 to 30 cm. long..... 51. *P. milleflorum*.

Culms not over 1 meter long; panicles 5 to 15 cm. long..... 52. *P. pilosum*.

**49. *Panicum longum* Hitchc. & Chase.**  
*Panicum longum* Hitchc. & Chase, Contr. U. S. Nat. Herb. **15**: 111. 1910.

DISTRIBUTION.

Swamps, State of Veracruz. The only collections known are from near Jalapa, *Pringle* 8195 (the type) and *Schiede & Deppe* 674 (Halle Herb.).



FIG. 68.—Distribution of *P. longum*.

**50. *Panicum polygonatum* Schrad.**

*Panicum polygonatum* Schrad. in Schult. Mant. **2**: 256. 1824; Contr. U. S. Nat. Herb. **15**: 112. 1910.

DISTRIBUTION.

Swamps and moist soil, Mexico to Paraguay. The type specimen from Brazil.

- VERACRUZ: Córdoba, *Bourgeau* 1662 in part.  
GUATEMALA: Sepacuité, *Collins & Goll* 08, *Cook & Griggs* 530. Cubilquitz, *Türkheim* 7797, 8795. Puerto Barrios, *Kellerman* 5114.  
HONDURAS: San Pedro Sula, *Thieme* 781, 5578, 5587 in part.



COSTA RICA: Boruca, *Tonduz* 4460. Puerto Limon, *Hitchcock* 8421. Llano Grande de Puriscal, *Jiménez* 881. Hacienda de Guácimo, *Tonduz* 27. San José, *Pittier* 1183. Echeverría, *Pittier & Tonduz* 2479. Carrillo, *Biolley* 3107, *Pittier* 1182. Talamanca, *Tonduz* 8557. River Tórres, San Francisco, *Jiménez* 126. Tuís, *Tonduz* 11396. Turrialba, *Tonduz* 4092, 8244. Buenos Aires, *Tonduz* 4042. Río Tuís, *Tonduz* 8187. Boca Zhorquín, *Tonduz* 8557. Quebrada de Tocorí, *Tonduz* 7542. Santo Domingo de Golfo Dulce, *Tonduz* 10099. Piedra del Convento, *Pittier* 3650.

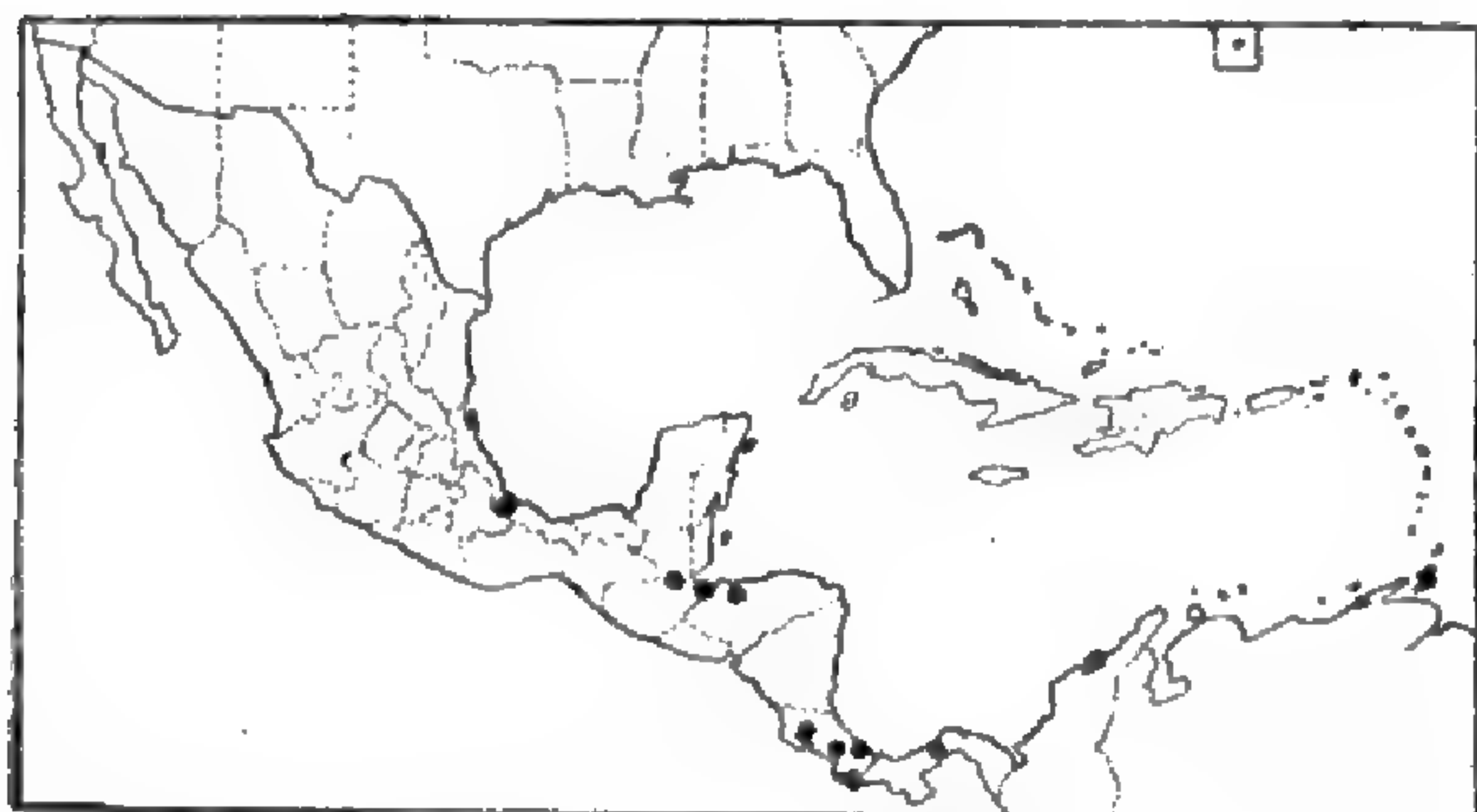


FIG. 69.—Distribution of *P. polygonatum*.

PANAMA: Boca del Toro, *Hart* 73. Mount Hope, *Hitchcock* 9172. Between Mindí and Colón, *Hitchcock*

7943. Between Bohío and Frijoles, *Hitchcock* 8395. Gorgona, *Amer. Gr. Nat. Herb.* 58.

TRINIDAD: Arima, *Hitchcock* 10297, 10306. Cumuto Station, *Hitchcock* 10077. Port of Spain, *Hitchcock* 9953. Tabaquite, *Hitchcock* 10132. Caparo, *Broadway* 2837.

TOBAGO: Mason Hall, *Broadway* 4476.

COLOMBIA: Santa Marta, *Smith* 206, 2190, 2747.

### 51. *Panicum milleflorum* sp. nov.

#### DESCRIPTION.

Plants perennial; culms ascending or erect from an elongated creeping base, rooting at the nodes, glabrous, 0.8 to 2 meters high, 4 to 5 mm. thick, compressed, the nodes pubescent or glabrous, usually with one to several long erect panicle-bearing branches; sheaths about as long as the internodes, keeled toward the summit, ciliate on the margin and puberulent at the junction with the blade, otherwise glabrous or sparsely papillose-hispid; ligule wanting, the ligular region puberulent; blades flat, 20 to 40 cm. long, 1 to 2 cm. wide, rarely wider, long-acuminate, somewhat narrowed to the subcordate base, glabrous or very sparsely hirsute, the margin scabrous; panicles 20 to 35 cm. long, about 6 cm. wide, in outline tapering to both ends, consisting of numerous ascending or spreading, often curving, slender spikelike branches, solitary or in fascicles along an elongated glabrous axis, the lower distant, the upper approximate, the scabrous-angled, often sparsely pilose rachises bearing throughout their length along their lower side evenly disposed short approximate densely flowered branchlets, those of the lower branches sometimes as much as 15 mm. long, the others 1 or 2 mm. long; spikelets subsessile, 1.3 mm. long, about 0.5 mm. wide, glabrous, the first glume about one-third the length of the spikelet, the second glume and sterile lemma equal, the lemma inflated boat-shaped with a large membranaceous palea; fruit 1.2 mm. long, 0.4 mm. wide, acute, the lemma boat-shaped.



FIG. 70.—*P. milleflorum*.  
From type specimen.

Type in the U. S. National Herbarium, no. 693327, collected in water of swamp, Frijoles, Canal Zone, Panama, October 12, 1911, by A. S. Hitchcock (no. 8387).

This species differs from *Panicum pilosum* in its larger size, its strong decumbent rooting base, and its longer blades and panicles. It appears to be the same as *Panicum distichum lancifolium* Griseb.<sup>1</sup> which was previously included<sup>2</sup> under *P. pilosum*.

<sup>1</sup> Fl. Brit. W. Ind. 548. 1864.

<sup>2</sup> Contr. U. S. Nat. Herb. 15: 114. 1910.



Grisebach's variety was based upon *Crueger* 84 from Trinidad. This has strongly appressed-hispid nodes and sparsely pilose panicle branches. Hitchcock's no. 8387, the type, has only moderately pubescent nodes and no hairs on the branches of the panicle. Hitchcock's no. 7942 has glabrous nodes, evidently, though sparsely, pilose blades, and strongly pilose panicle branches. The three collections appear, however, to belong to the same species. Frijoles, the type locality, is now covered by the water of Gatun Lake.

#### DISTRIBUTION.

Swamps, Panama to Trinidad.

PANAMA: Frijoles, Canal Zone, *Hitchcock* 8387. Between Mindí and Colón, Canal Zone, *Hitchcock* 7942.

TRINIDAD: Without locality, *Crueger* 84.



FIG. 71.—Distribution of *P. milleflorum*.

#### 52. *Panicum pilosum* Swartz.

*Panicum pilosum* Swartz, Prodr. Veg. Ind. Occ. 22. 1788; Contr. U. S. Nat. Herb. 15: 113. 1910.

#### DISTRIBUTION.

Moist ground, ditches, and swamps, Mexico and the West Indies to Paraguay. The type specimen from Jamaica.

VERACRUZ: Córdoba, *Amer. Gr. Nat. Herb.* 60. Mirador, *Liebmann* 411.

TABASCO: San Juan Bautista, *Rovirosa* 599.

CHIAPAS: Ocuilapa, *Nelson* 3056.

BRITISH HONDURAS: Manatee Lagoon, *Peck* 28 (*Gray Herb.*).

GUATEMALA: Finca Trece Aguas, *Goll* 11. Cubilquitz, *Türckheim* 8797. Puerto Barrios, *Hitchcock* 9159. Los Andes, *Kellerman* 5119.

HONDURAS: San Pedro Sula, *Thieme* 5587 in part. Bonacco Island, *Gaumer* in 1887.

NICARAGUA: *Wright*, U. S. Pacific Expl. Exped. 1853-56.

COSTA RICA: Río Hondo, *Cook & Doyle* 499. Talamanca, *Tonduz* 9495. Puerto Viejo, *Biolley* 7463. Puntarenas, *Hitchcock* 8564.

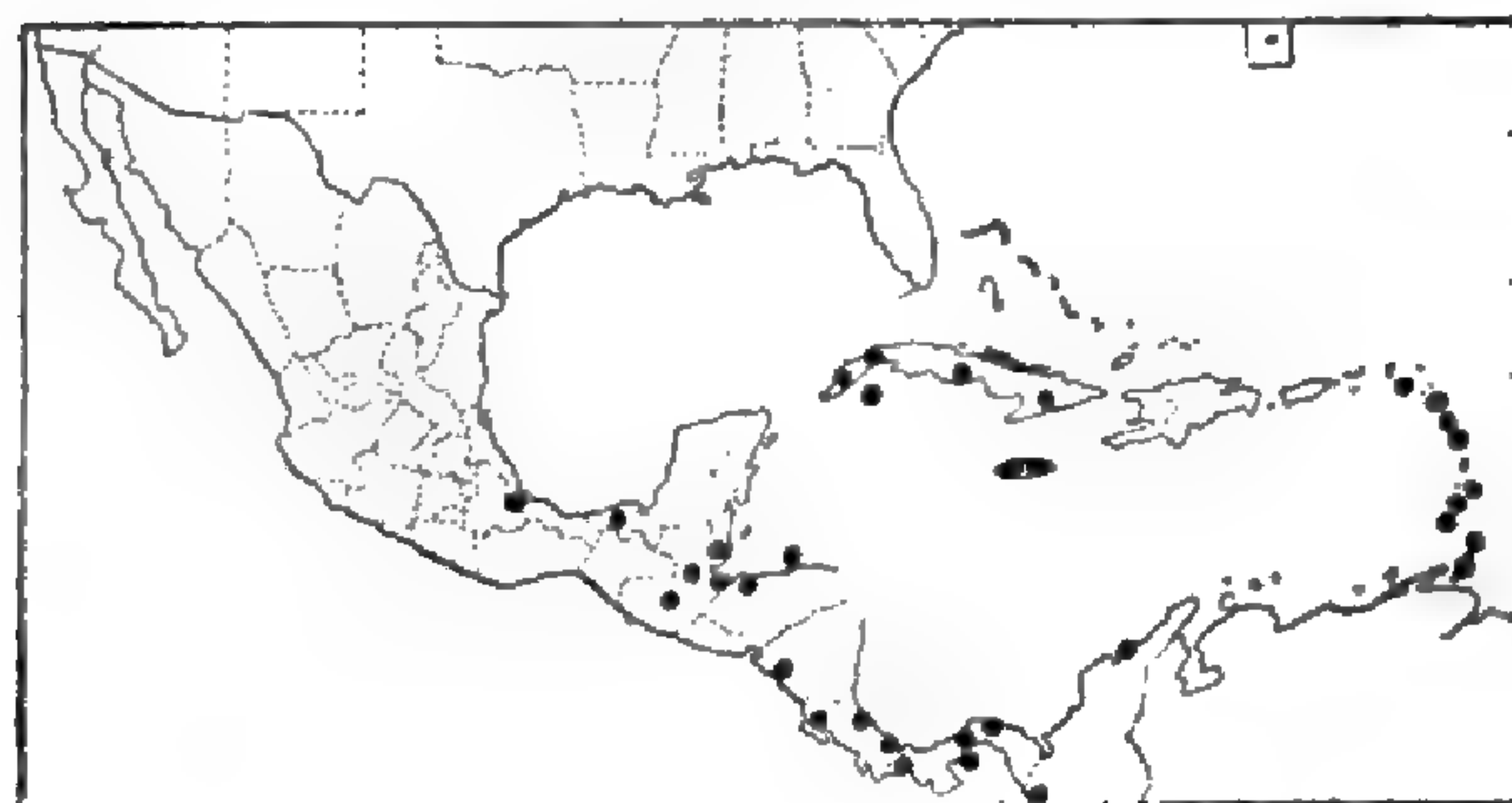


FIG. 72.—Distribution of *P. pilosum*.

PANAMA: Chagres, *Fendler* 368. Chepo, *Pittier* 4536. Puerto Obaldía, *Pittier* 4371. Toro Point, *Hitchcock* 8044. Taboga Island, *Hitchcock* 8083. Balboa, *Hitchcock* 8016. Gatun, *Hitchcock* 8029. Caña, *Williams* 776. David, *Hitchcock* 8347. Culebra, *Hitchcock* 7897, 9208, *Pittier* 2082. Between Bohío and Frijoles, *Hitchcock* 8390. Between Pedro Miguel and Corozal, *Hitchcock* 7992. Chorrera, *Hitchcock* 8139. Porto Bello, *Pittier* 2481.

CUBA: Dayaniguas, *Wright* 3451 in part. Sancti Spiritus, *León* 908. Herradura, *Van Hermann* 763, *Tracy* 9063. Isle of Pines, *Curtiss* 305, *Taylor* 36. Sumidero, *Shafer* 13505, 13533. Buenaventura, *Wilson* 9444. Banao Hills, *León* 3982. Near Marianao, *León* 1977. Without locality, *Pöppig* 1834.



JAMAICA: Troy, *Hitchcock* 9782. Ramble, *Hitchcock* 9517. Bull Head Mountain, *Hitchcock* 9548. Castleton Gardens, *Hitchcock* 9407. Ewarton to Linstead, *Hitchcock* 9423. Ipswich, *Hitchcock* 9626. Navy Island, *Millspaugh* 1859. Port Morant, *Hitchcock* in 1890. Portland, *Harris* 11524. Castleton, *Harris* 11280a. Gordon Town, *Hart* 732. Cedar Hurst, *Harris* 11547.

LEEWARD ISLANDS: St. Kitts, *Britton & Cowell* 287 (K. U. Herb.). Guadeloupe, *Duss* 4154. Dominica, *Imray* 151312, *Jones* 20.

WINDWARD ISLANDS: St. Vincent, *Eggers* 6562, 6633 (K. U. Herb.). Grenada, St. Georges, *Broadway* in 1904. Martinique, *Duss* 534, 4018 (both in K. U. Herb.). Barbados, *Eggers* 7195 (K. U. Herb.).

TRINIDAD: Piarco Savanna, *Hitchcock* 10358. Port of Spain, *Hitchcock* 9961, 10045, *Hart* 3293. Tabaquite, *Hitchcock* 10121. Cedros, *Amer. Gr. Nat. Herb.* 59. Arima, *Hitchcock* 10309.

TOBAGO: Brushfield, *Eggers* 5534. Scarborough, *Hitchcock* 10208. Castara, *Broadway* 4063. Center of island, *Hitchcock* 10265. Spey Side, *Hitchcock* 10242.

COLOMBIA: Córdoba, *Pittier* 557. Santa Marta, *Smith* 203.

### 53. *Panicum boliviense* Hack.

*Panicum boliviense* Hack. Repert. Nov. Sp. Fedde **11**: 19. 1912. "Bolivia: Antahuacana, Espirito Santo in alveo arenoso fluminis \* \* \* leg. Dr. O. Buchtien no. 2501." A portion of the type was sent by Prof. Hackel for deposit in the National Herbarium.

#### DESCRIPTION.

Plants perennial with long decumbent or creeping bases, rooting and branching at the lower nodes; flowering culms ascending, 0.5 to 1.5 meters high, glabrous, the nodes glabrous; sheaths short, glabrous below, usually hirsute toward the summit, especially at the junction with the blade, the margins ciliate; ligule a ciliate membrane about

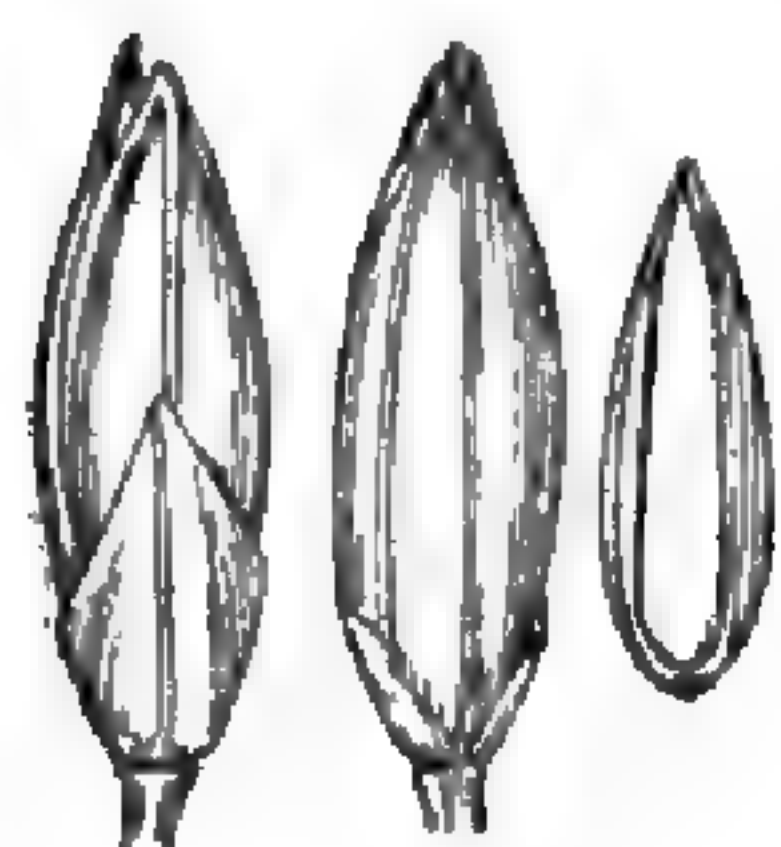


FIG. 73.—*P. boliviense*. From type specimen.

0.5 mm. long; blades flat, 8 to 15 cm. long, 1 to 2 cm. wide, gradually narrowed from the cordate-clasping base to an acuminate apex, ciliate at base, otherwise glabrous, obscurely cross-nerved between the veins, the margins scabrous; panicle usually short-exserted, 10 to 25 cm. long, one-third to half as wide, the solitary or fascicled branches increasingly approximate toward the summit of the slender angled scabrous axis, usually pilose in the axils, the lowermost branch solitary and remote, all but the uppermost compound, the branchlets somewhat spikelike, rather distant, usually along the lower side of the rachis, the axils pilose; spikelets subsessile, clustered, 1.5 to 1.6 mm. long, about 0.7 mm. wide, turgid, the first glume nearly half the length of spikelet, the second glume and sterile lemma equal, the sterile lemma somewhat inflated, subtending a membranaceous palea; fruit 1.4 mm. long, 0.6 mm. wide, subacute.

Several collections of this species were referred in the Revision<sup>1</sup> to *P. laxum* as exceptionally robust specimens with cordate blades and turgid spikelets.

#### DISTRIBUTION.

Ditches, banks of streams, moist open or wooded ground, southern Mexico and Cuba to Paraguay.

VERACRUZ: Veracruz, *Hitchcock* 6582. Mirador, *Liebmann* 419. Córdoba, *Finck* 3, *Hitchcock* 6435, 6457. Zacuapán, *Purpus* 2159, 2160. Misantla, *Purpus* 5980. Jalapa, *Hitchcock* 6666.



FIG. 74.—Distribution of *P. boliviense*.

<sup>1</sup> Contr. U. S. Nat. Herb. **15**: 116. 1910.



GUATEMALA: Cobán, *Türckheim* 1254.

PANAMA: Along ditch to Old Panama, *Hitchcock* 8400.

CUBA: Sancti Spiritus, *León* 909. Isle of Pines, *Curtiss* 464. Baños San Vicente, *Britton & Gager* 7452.

#### 54. *Panicum laxum* Swartz.

*Panicum laxum* Swartz, Prodr. Veg. Ind. Occ. 23. 1788; Contr. U. S. Nat. Herb. 15: 115. 1910.

#### DISTRIBUTION.

Ditches, banks, moist woods and wet savannas, Mexico and West Indies to Paraguay. The type specimen from Jamaica.

SINALOA: Culiacán, *Palmer* 1558 in 1891.

VERACRUZ: Coatepec, *Hitchcock* 6665. Jalapa, *Hitchcock* 6624. Córdoba, *Hitchcock* 6421, 6433. Veracruz, *Hitchcock* 6583. Sanborn, *Orcutt* 3238. Mirador, *Liebmann* 412. Orizaba, *Botteri* 688.

TABASCO: Mayito, *Rovirosa* 427.

BRITISH HONDURAS: Manatee Lagoon, *Peck* 60 (Gray Herb.).

GUATEMALA: Puerto Barrios, *Pittier* 361, *Hitchcock* 9160. Cubilquitz, *Türckheim* 8803. Santa Rosa, *Heyde & Lux* 3900. Cobán, *Türckheim* 3832.

HONDURAS: San Pedro Sula, *Thieme* 5587.

SALVADOR: Sonsonate, *Hitchcock* 8971.

NICARAGUA: Corinto, *Hitchcock* 8748.

COSTA RICA: Buenos Aires, *Tonduz* 4864, 4868, 4871, *Pittier* 3657. Río Birris, *Pittier* 3117. Turrialba, *Tonduz* 8267, *Pittier* 16123. Río Grande de Térraba, *Tonduz* 3622. Boruca, *Tonduz* 4473. Carrillo, *Biolley* 3107. Port Limon, *Hitchcock* 8429. San José, *Hitchcock* 8455. Río Maravilla, Alajuela, *Jiménez* 141. Puntarenas, *Hitchcock* 8566. Río Bebedero, *Jiménez* 740. Río Tilirí, *Tonduz* 3071.

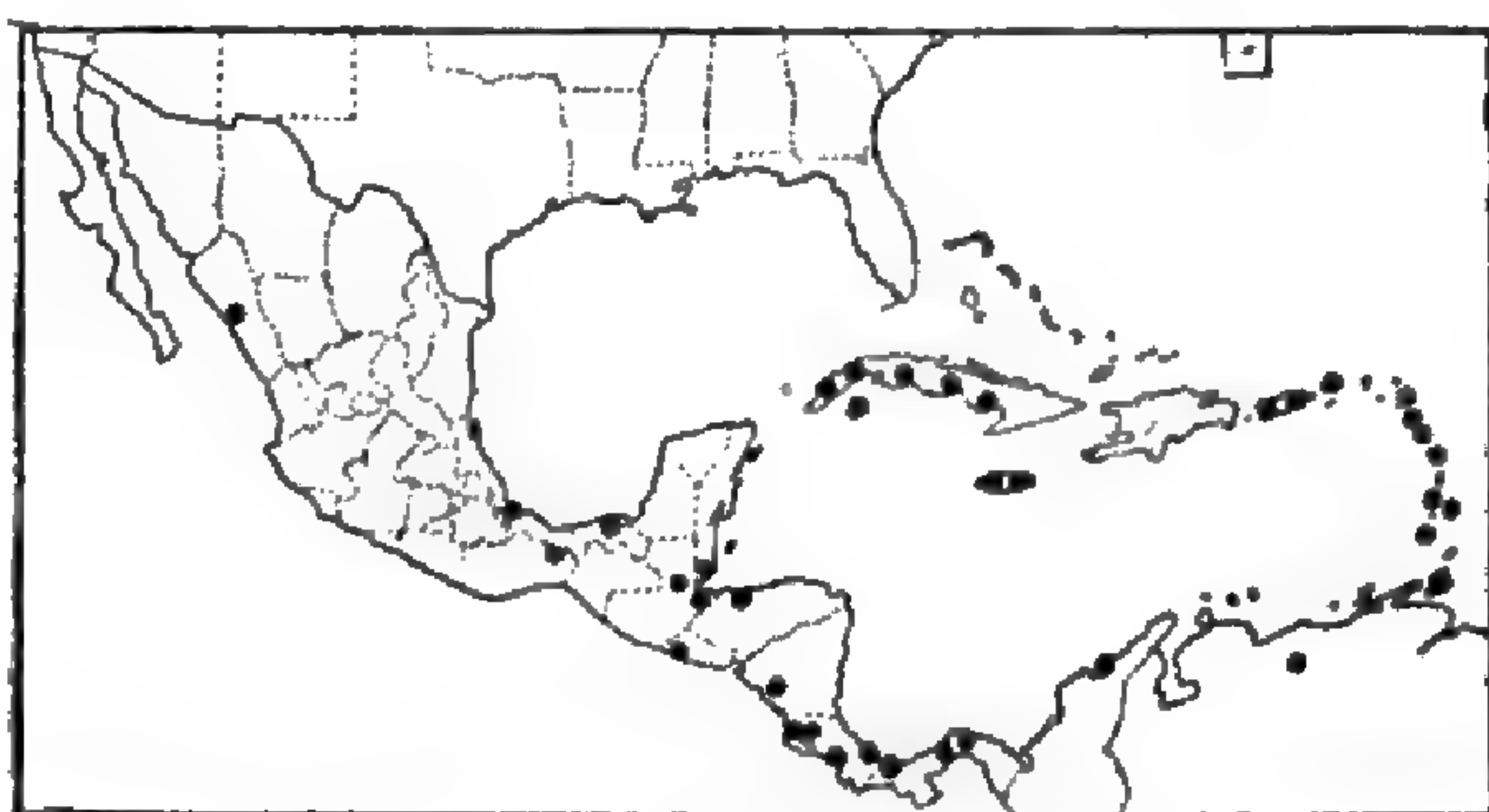


FIG. 75.—Distribution of *P. laxum*.

PANAMA: Gatun, *Hitchcock* 7968, 8027. Boca del Toro, *Hart* 86. Porto Bello, *Pittier* 2443. Culebra, *Hitchcock* 7900. David, *Hitchcock* 8346, 8350. Chepo, *Pittier* 4615. Vicinity of Olá, *Pittier* in 1911. Gamboa, *Pittier* 4789. Along Sambú River, *Pittier* 5234. Chorrera, *Hitchcock* 8134. Between Pedro Miguel and Corozal, *Hitchcock* 7993. Dolega, *Hitchcock* 8334.

CUBA: Sancti Spiritus, *León* 907, *Sergius* 2781, *Pöppig* 6. Hanábana, *Wright* 189, 196, 197. Isle of Pines, *Taylor* 37, *Palmer & Riley* 1069. Herradura, *Caldwell & Baker* 7136, *Tracy* 9054, 9062, 9072, 9099, *Hitchcock* 177. Santiago de las Vegas, *Hitchcock* 178, *Tracy* 9114. Banao Hills, *León* 3982½. Guanabacoa, *León* 914. Wajay, *Earle & Wilson* 343. Zaza del Sur, *Sergius* 2780. Camaguey, *Shafer* 217. Sumidero, *Shafer* 13724. Los Palacios, *Shafer* 11793. La Gloria, *Shafer* 174. Without locality, *Wright* 759, 3451, 3863.

JAMAICA: Bull Head Mountain, *Hitchcock* 9539, 9545. Castleton Gardens, *Hitchcock* 9397. Ewarton to Linstead, *Hitchcock* 9461. Appleton, *Hitchcock* 9658. Gordon Town, *Hitchcock* 9333. Troy, *Hitchcock* 9786. Castleton, *Harris* 11285. Below Flamstead, *Harris* 11466.

SANTO DOMINGO: Jarabacoa, *Eggers* 2120.



PORTO RICO: Between Aibonito and Cayey, *Chase* 6341, *Heller* 522. Arecibo, *Chase* 6440. Sierra Luquillo, *Hioram* 368, *Chase* 6713. Adjuntas Road, *Heller* in 1902. Cataño, *Heller* 1378. Utuado, *Britton & Cowell* 394. Mayaguez, *Chase* 6155, 6185, *Sintenis* 360. Along Rio Coamo, *Chase* 6549. Trujillo Alto, *Chase* 6363, 6775. Jajome Alto, *Chase* 6753. Santurce, *Chase* 6354. Mount Morales, *Britton & Marble* 1068. Fajardo, *Sintenis* 1254.

DANISH WEST INDIES: St. Thomas, *Eggers* 874 (K. U. Herb.).

LEEWARD ISLANDS: Antigua, *Wulfschlaegel* 623. Guadeloupe, *Duss* 3179. Dominica, *Jones* 21, 25.

WINDWARD ISLANDS: Martinique, *Duss* 535, 716 (K. U. Herb.). Barbados, *Dash* 450. St. Lucia, *Voyage of the Albatross* in 1887-88. Grenada, *Broadway* 1870, 3712, 4668.

TRINIDAD: Port of Spain, *Hitchcock* 9984. Piarco Savanna, *Hitchcock* 10343, 10351, 10361. Brighton, *Hitchcock* 10098. Pitch Lake, *Hitchcock* 10091. Cumuto Station, *Hitchcock* 10068. Cedros, *Hitchcock* 10149, *Bot. Gard. Herb.* 2177, 2289.

TOBAGO: Center of island, *Hitchcock* 10272. Spey Side, *Hitchcock* 10245.

VENEZUELA: Llanos del Alto Apure, *Jahn* 201.

COLOMBIA: Córdoba, *Pittier* 521, 553. Calí, *Pittier* 665. Santa Marta, *Smith* 202, 204.

### 55. *Panicum stevensianum* sp. nov.

#### DESCRIPTION.

Plants perennial, tufted, glabrous throughout; culms compressed, 30 to 60 cm. long, spreading, prostrate, rooting at the nodes, the flowering ends and the branches ascend-

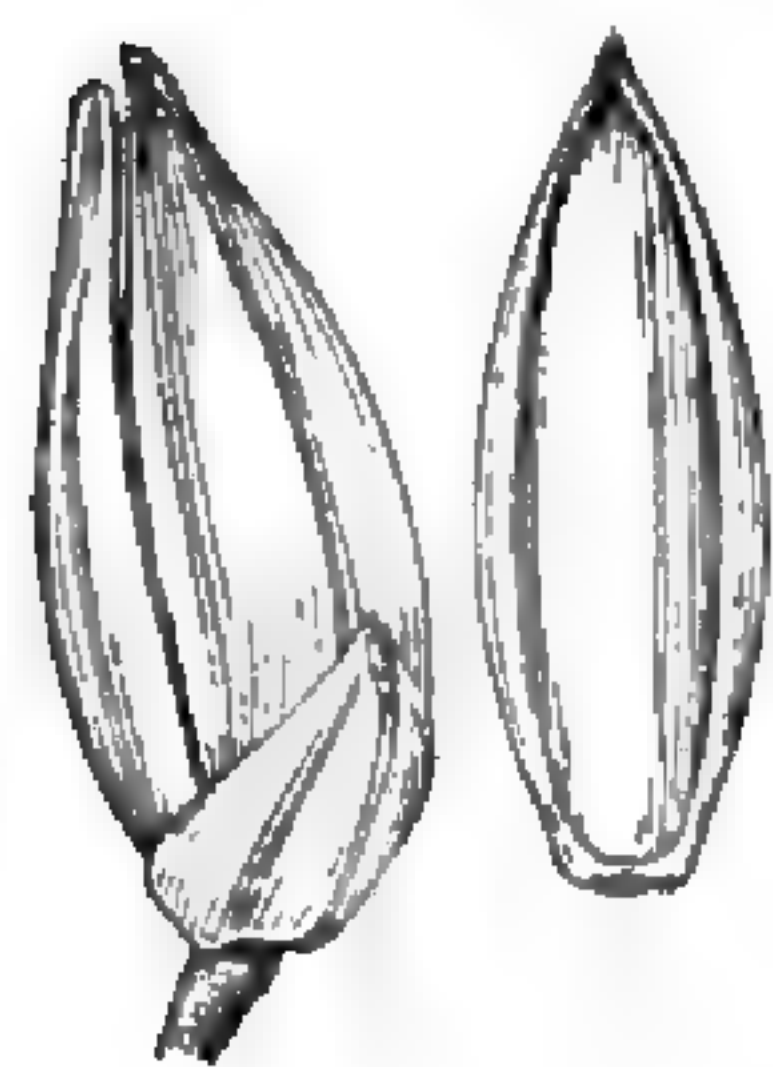


FIG. 76.—*P. stevensianum*.  
From type specimen.

ing; sheaths loose, much shorter than the internodes, compressed, keeled, ciliate on the overlapping margin; ligule a delicate membrane about 0.5 mm. long; blades flat, rather firm, more or less spreading, 4 to 10 cm. long, 5 to 10 mm. wide, tapering from a little above the sparsely ciliate, truncate-cordate base to an acuminate apex; panicles terminal on the culm and branches, short-exserted, 6 to 10 cm. long, narrow, consisting of several appressed or ascending spikelike branches along an angled axis, the lower branches somewhat remote, 1.5 to 3 cm. long, usually longer than the internodes, the upper approximate, all spikelet-bearing to the base, the short-pedicelled spikelets in crowded clusters, not secund, along a slender scabrous rachis; spikelets about 2 mm. long and 0.8 mm. wide, acute,

somewhat inflated and gaping; first glume about one-fourth the length of the spikelet, subacute, 3-nerved; second glume and sterile lemma equal, pointed, slightly exceeding the fruit, 3 to 5-nerved, the lemma inclosing a large palea and abortive perfect flower; fruit 1.9 mm. long, 0.6 mm. wide, minutely scabrous at the acute apex.

Type in the U. S. National Herbarium, no. 693323, collected "on wet sand around pool, forming a dense carpet, white sand region, Campo Alegre near Laguna del Tortuguero," Porto Rico, November 25, 1913, by Agnes Chase (no. 6616).

This species appears to be most nearly related to the South American *P. milioides* Nees, from which it differs in the short erect panicle branches, spikelet-bearing to the base.



FIG. 77.—Distribution of *P. stevensianum*.



None of the specimens collected is mature. It may be that the large sterile palea becomes indurated at maturity as in *P. hians* and its close allies. The species is named in honor of Dr. F. L. Stevens of the University of Illinois, who, during the three years he was dean of the College of Agriculture and Mechanic Arts of Porto Rico, was an ardent student of the flora of the island and who contributed greatly to the success of a botanical trip made by one of the authors to Porto Rico in 1913.

Since this work went to press a second collection of this species has been received: *Wilson* 9558, Laguna de Castellano, Cuba.

#### 56. *Panicum exiguiflorum* Griseb.

*Panicum exiguiflorum* Griseb. Cat. Pl. Cub. 234. 1866; Contr. U. S. Nat. Herb. **15**: 117, 1910.

##### DISTRIBUTION.

Savannas and moist sandy woods, Bahamas and Cuba. The type specimen from Cuba.

BAHAMAS: Fortune Island, *Hitchcock* in 1890.

CUBA: Hanábana, *Wright* in 1865. Sancti Spiritus, *Sergius* 2566. Obispo Hill, *León* 902b. Zaza del Medio, *León* 902. Guanabacoa, *León* 911, 913. Chirigote, *Wright* 3450. Herradura, *Hitchcock* 179, *Tracy* 9075. Isle of Pines, *Taylor* 35. Without locality, *Wright* 755, 3450, 3877.



FIG. 78.—Distribution of *P. exiguiflorum*.

#### 57. *Panicum hians* Ell.

*Panicum hians* Ell. Bot. S. C. & Ga. **1**: 118. 1816; Contr. U. S. Nat. Herb. **15**: 118. 1910.

##### DISTRIBUTION.

Savannas and moist soil along ponds and streams, North Carolina to New Mexico and in Veracruz, Mexico. The type specimen from South Carolina.

VERACRUZ: Jalapa, *Schiede*. Without locality, *Müller* 2095.

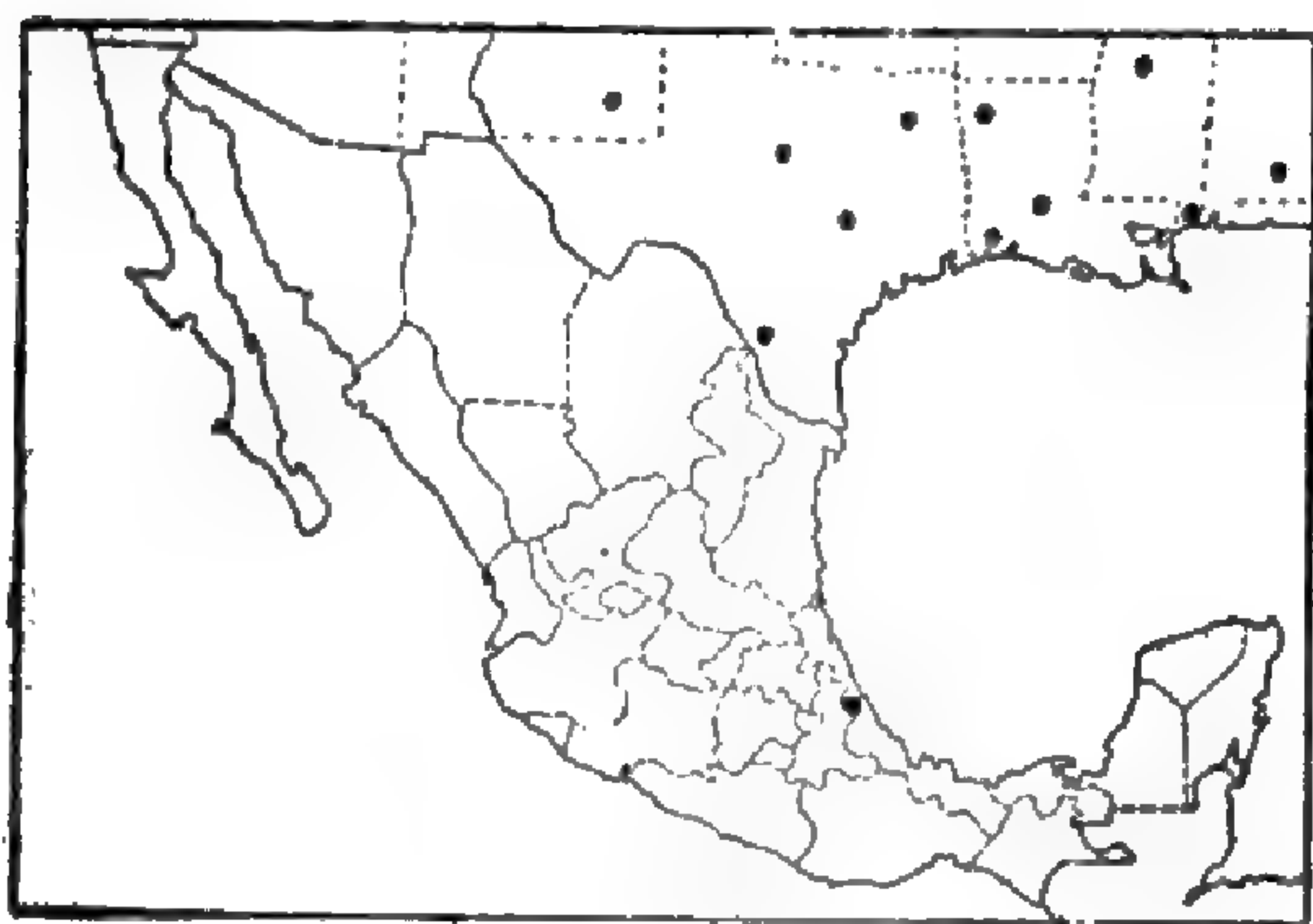


FIG. 79.—Distribution of *P. hians*.

#### 58. *Panicum cupreum* Hitchc. & Chase.

*Panicum cupreum* Hitchc. & Chase, Contr. U. S. Nat. Herb. **15**: 120. 1910.

##### DISTRIBUTION.

Only known from the type collection, in "wet hollows in prairies of Flor de Maria, State of Mexico," *Pringle* 3449.



FIG. 80.—Distribution of *P. cupreum*.



## STOLONIFERA.

Spikelets hispid and with 2 crateriform glands on the sterile lemma; second glume and sterile lemma not boat-shaped.

Spikelets not over 2 mm. long; blades not over 4 cm. long.. 61. *P. pulchellum*.

Spikelets 3.6 mm. long; blades 4 to 10 cm. long..... 62. *P. biglandulare*.

Spikelets glabrous, glandless; second glume and sterile lemma boat-shaped.

Blades not over 5 cm., usually 2 or 3 cm., long; second glume rather blunt and shorter than the sterile lemma..... 59. *P. stoloniferum*.

Blades 5 to 11 cm. long; second glume acute, nearly equaling the sterile lemma..... 60. *P. frondescens*.

59. *Panicum stoloniferum* Poir.

*Panicum stoloniferum* Poir. in Lam. Encycl. Suppl. 4: 274. 1816; Contr. U. S. Nat. Herb. 15: 121. 1910.

## DISTRIBUTION.

Moist shady places, Guatemala to Brazil. The type specimen from Cayenne.



FIG. 81.—Distribution of *P. stoloniferum*.

GUATEMALA: Puerto Barrios, *Pittier* 364.

PANAMA: Frijoles, *Amer. Gr. Nat. Herb.* 62.

WINDWARD ISLANDS: Martinique, *Duss* 1291 (K. U. Herb.).

TRINIDAD: St. Ann's Valley, *Bot. Gard. Herb.* 2293. Aqua Santa Arima, *Broadway* 2370. Without locality, *Crueger* 79.

60. *Panicum frondescens* Meyer.

*Panicum frondescens* Meyer, Prim. Fl. Esseq. 56. 1818; Contr. U. S. Nat. Herb. 15: 121. 1910.

*Hymenachne frondescens* Fourn. Mex. Pl. 2: 36. 1886. Based on *Panicum frondescens* Meyer.

A specimen in the Berlin Herbarium, *Seler* 5024, without locality other than Mexico and Central America, is exceptionally lax and is peculiar in having occasional spikelets with glands on the sterile lemma as in *P. pulchellum* and *P. biglandulare*. In most of the spikelets there are a few hairs along the margin of the sterile lemma. Further collections may show this to be a distinct species. In *Pittier* 6328, cited below, a few spikelets bear glands, but all are glabrous.

## DISTRIBUTION.

Moist woods, Mexico to Brazil. The type specimen from British Guiana.

VERACRUZ: Papantla, *Liebmann* 405.

TABASCO: Sebastián, *Rovirosa* 497.

GUATEMALA: Dept. Petén, *Walker* 1138.

COSTA RICA: Hacienda de Zent, *Tonduz* 259.

PANAMA: Trinidad Basin, *Pittier* 4027.



FIG. 82.—Distribution of *P. frondescens*.



WINDWARD ISLANDS: *Smith & Smith* 187 (K. U. Herb.).

TRINIDAD: Aqua Santa Arima, *Broadway* 2371. Blanchisseuse, *Broadway* 2390. Without locality, *Crueger* 85.

VENEZUELA: Above Paparo, *Pittier* 6328.

COLOMBIA: Santa Marta, *Smith* 2126, 2571.

# 61. *Panicum pulchellum* Raddi.

*Panicum pulchellum* Raddi, *Agrost. Bras.* 42. 1823; *Contr. U. S. Nat. Herb.* 15: 123. 1910.

*Hymenachne leptostachya* Fourn. *Mex. Pl.* 2: 36. 1886. Based on *Panicum leptostachyum* Presl.

## DISTRIBUTION.

Moist shady places, southern Mexico and the Windward Islands to Brazil. The type specimen from Rio de Janeiro.

VERACRUZ: Córdoba, *Hitchcock* 6444, *Bourgeau* 1455. Minatitlán, *Smith* 589.

BRITISH HONDURAS: Manatee Lagoon, *Peck* 279 (Gray Herb.).

GUATEMALA: Cubilquitz, *Türckheim* 7702, 8794. Secanquím, *Cook & Griggs* 284, *Maxon & Hay* 3153. El Palmar, *Kellerman* 6246.

COSTA RICA: San Francisco, *Jiménez* 162. San Mateo, *Biolley* 7001. Desamparados, *Tonduz* 1482. Boruca, *Tonduz* 4459, 4460. El General, *Pittier* 3362. Piedra del Convento, *Pittier* 3656. Cañas Gordas, *Pittier* 7360. Buenos Aires, *Tonduz* 4881.

PANAMA: Between Panama and Corozal, *Amer. Gr. Nat. Herb.* 63. Culebra, *Pittier* 2226. Cerro Vaca, *Pittier* 5375.

WINDWARD ISLANDS: Martinique, *Duss* 767 (K. U. Herb.).

VENEZUELA: Cárdenas, *Pittier* 5975.

COLOMBIA: Santa Marta, *Smith* 2127.



FIG. 83.—Distribution of *P. pulchellum*.

# 62. *Panicum biglandulare* Scribn. & Smith.

*Panicum biglandulare* Scribn. & Smith, *U. S. Dept. Agr. Div. Agrost. Bull.* 4: 13. pl. 4. 1897; *Contr. U. S. Nat. Herb.* 15: 123. 1910.

## DISTRIBUTION.

Among bushes, southern Mexico and Guatemala. The type specimen from Chiapas.

CHIAPAS: Pinabete, *Nelson* 3781.

GUATEMALA: Cobán, *Türckheim* II. 1342, II. 1956.



FIG. 84.—Distribution of *P. biglandulare*.



## PARVIGLUMIA.

- Fruit glabrous..... 66. *P. parviglume*.  
 Fruit with scattered appressed silky hairs.  
   Culms creeping, with ascending flowering branches, not over  
     0.5 meter high; blades falcate..... 64. *P. schmitzii*.  
   Culms clambering, usually 1 to 3 meters long; blades not  
     falcate.  
     Panicles 2.5 to 7 cm. long; blades not over 1 cm. wide,  
       symmetrical at base..... 63. *P. virgultorum*.  
     Panicles 10 to 15 cm. long; blades 1.2 to 2.5 cm. wide,  
       unsymmetrical at base..... 65. *P. schiffneri*.

**63. *Panicum virgultorum* Hack.**

*Panicum virgultorum* Hack. Oesterr. Bot. Zeitschr. **51**: 369. 1901; Contr. U. S. Nat. Herb. **15**: 125. 1910.

## DISTRIBUTION.

Hedge rows, brushy banks, and cultivated fields, southern Mexico to Panama. The type specimen from Costa Rica.



FIG. 85.—Distribution of *P. virgultorum*.

VERACRUZ: Jalapa, *Hitchcock* 6630. Córdoba, *Hitchcock* 6441. Orizaba, *Amer. Gr. Nat. Herb.* 64.

GUATEMALA: Guatemala City, *Hitchcock* 9074. Chacula, *Seler* 2708. Cobán, *Türkheim* 3788.

COSTA RICA: San José, *Hitchcock* 8490. Alajuelita, *Tonduz* 8818, 8829. Tres Ríos, *Pittier &*

*Tonduz* 4326. San Francisco, Río Tórres, *Jiménez* 49. San Juan, *Jiménez* 919.

PANAMA: El Boquete, *Hitchcock* 8317.

**64. *Panicum schmitzii* Hack.**

*Panicum schmitzii* Hack. Ann. Naturhist. Hofm. Wien **17**: 254. 1902; Contr. U. S. Nat. Herb. **15**: 125. 1910.

## DISTRIBUTION.

Shaded rocky slopes, central and southern Mexico. The type specimen from Mexico.

SAN LUIS POTOSÍ: Las Canoas, *Pringle* 3817.

VERACRUZ: Córdoba, *Hitchcock* 6423, 6446. Orizaba, *Amer. Gr. Nat. Herb.* 65.



FIG. 86.—Distribution of *P. schmitzii*.

**65. *Panicum schiffneri* Hack.**

*Panicum schiffneri* Hack. Ergeb. Bot. Exped. Akad. Wiss. Südbas. 11. 1906; Denkschr. Kais. Akad. Wiss. Wien **79**: 72. 1908. The type specimen, in Hackel's herbarium, was collected in southern Brazil by Wettstein and Schiffner in 1901.



## DESCRIPTION.

Plants perennial with long branching decumbent base, rooting at the nodes; culms straggling, ascending, 2 to 3 meters long, slender, more or less compressed, smooth or hirsute or roughened below the nodes, producing long divaricate branches; sheaths papillose-hispid especially toward the summit, sometimes glabrate below, densely pubescent at the junction with the blade; ligule membranaceous-ciliate, about 0.5 mm. long; blades flat, rather firm, usually horizontally spreading, 10 to 15 cm. long, 1.2 to 2.5 cm. wide (rarely larger), narrowed to the usually unsymmetrical base, gradually tapering from below the middle to an acuminate apex, scabrous and sometimes sparsely hispid on the upper surface, pubescent above the ligule, scaberulous or puberulent beneath or sometimes sparsely hispid, especially along the midnerve, the fine white margin undulate, scabrous; panicle 10 to 15 cm. long, usually about as wide, the few slender scabrous branches remote, pilose in the axils, the lower branches solitary or in pairs, widely spreading or reflexed, more than half as long as the very scabrous main axis, naked at the base, the upper branches much shorter, ascending, the rather densely flowered short branchlets appressed along the upper half or two-thirds of the branches, the bract at the base of inflorescence usually well developed; spikelets short-pediceled, aggregated, scarcely 2 mm. long, 1 mm. wide, turgid, glabrous; first glume less than one-fourth as long as the spikelet; second glume and sterile lemma equal, exceeding the fruit, obscurely nerved; fruit about 1.5 mm. long, 0.9 mm. wide, elliptical, sparsely covered with long appressed silky hairs.

This species resembles *Panicum parviglume* in habit and *P. schmitzii* and *P. virgulatorum* in spikelet characters. It has longer, more straggling culms than has any other species of this group, and larger blades than any except *P. parviglume*.

## DISTRIBUTION.

Wet shady banks and slopes, Porto Rico, Windward Islands, and southern Mexico to southern Brazil.



FIG. 88.—Distribution of *P. schiffneri*.

VERACRUZ: Córdoba, *Amer. Gr. Nat. Herb.* 66, distributed as *P. parviglume*.

GUATEMALA: Cobán, *Turckheim* II. 1326.

COSTA RICA: San Francisco de Guadalupe, *Jiménez* in 1910.

PANAMA: El Boquete, *Hitchcock* 8278, 8305.

PORTO RICO: Maricao, *Chase* 6198. Indiera Fria, *Chase* 6247. Vicinity of Cayey, *Chase* 6745. Alto de Bandera, *Chase* 6474.

WINDWARD ISLANDS: Martinique, *Hahn* 616. St. Vincent, *Eggers* 6653, *Smith & Smith* 1099 (K. U. Herb.).

### 66. *Panicum parviglume* Hack.

*Panicum parviglume* Hack. *Oesterr. Bot. Zeitschr.* 51: 429. 1901; *Contr. U. S. Nat. Herb.* 15: 126. 1910.

*Panicum conchatum* Fourn. *Mex. Pl.* 2: 25. 1886. This was previously included among the doubtful species.<sup>1</sup> A few spikelets from Schaffner's no. 204 (the type

<sup>1</sup>*Contr. U. S. Nat. Herb.* 15: 329. 1910.

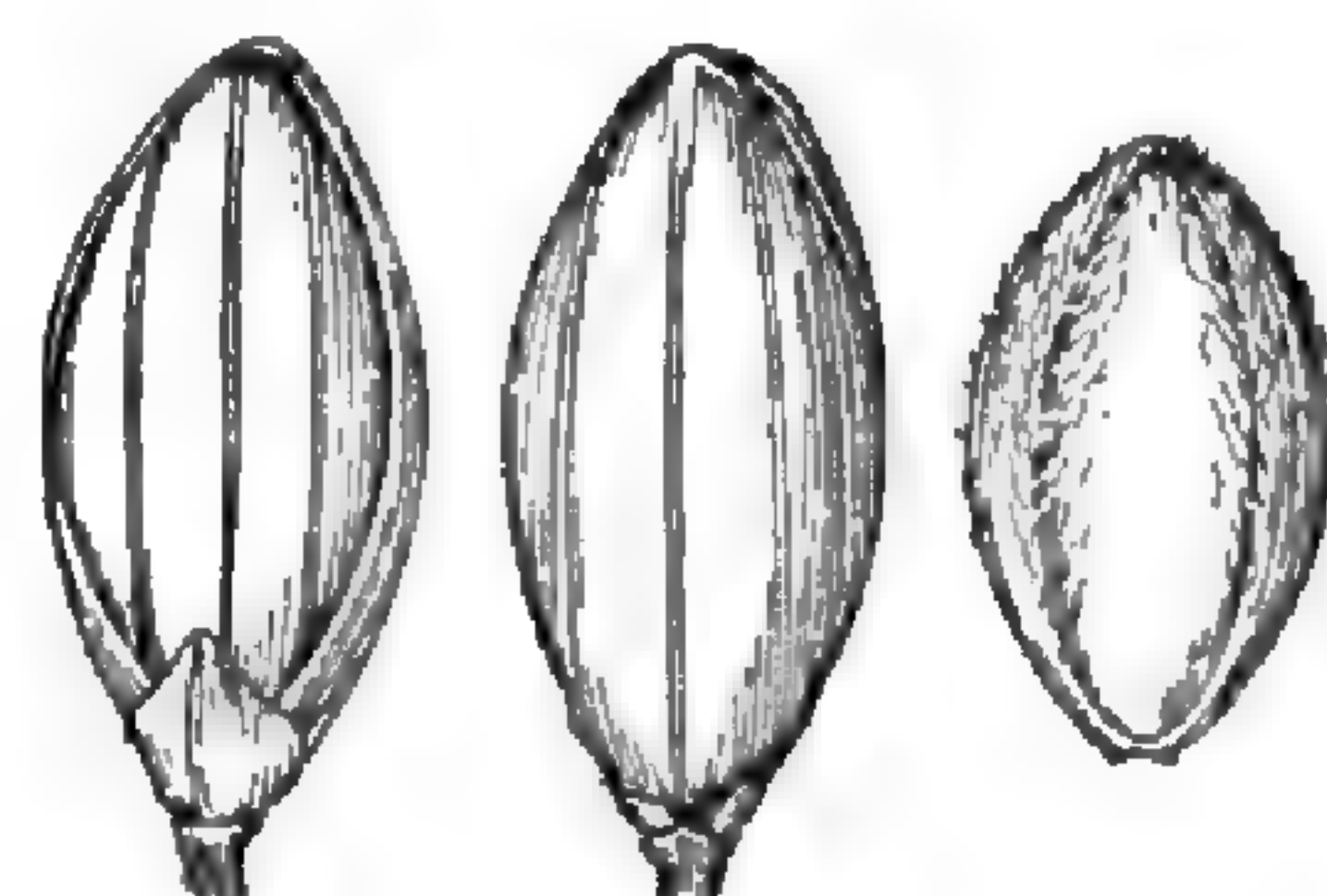


FIG. 87. — *P. schiffneri*. From type specimen.



collection) in the Berlin Herbarium are in the National Herbarium. A restudy of these together with later collections show that they are referable to *P. parviglume*. Fournier's description is vague and inadequate and appears to have been based on more than one species, the vegetative characters as described being unlike those of any species in this group. Because of this uncertainty the name *P. conchatum* is not taken up to replace *P. parviglume*.

*Panicum arundinariae* Trin.; Fourn. Mex. Pl. 2: 25. 1886. This name is also included among the doubtful species.<sup>1</sup> Müller's no. 2018, one of the specimens cited by Fournier, is *P. parviglume*, while another, *Schaffner* 279, also cited, is *Panicum virgultorum*. As in the preceding case, the description is inadequate, for which reason the name *P. arundinariae* is not taken up.

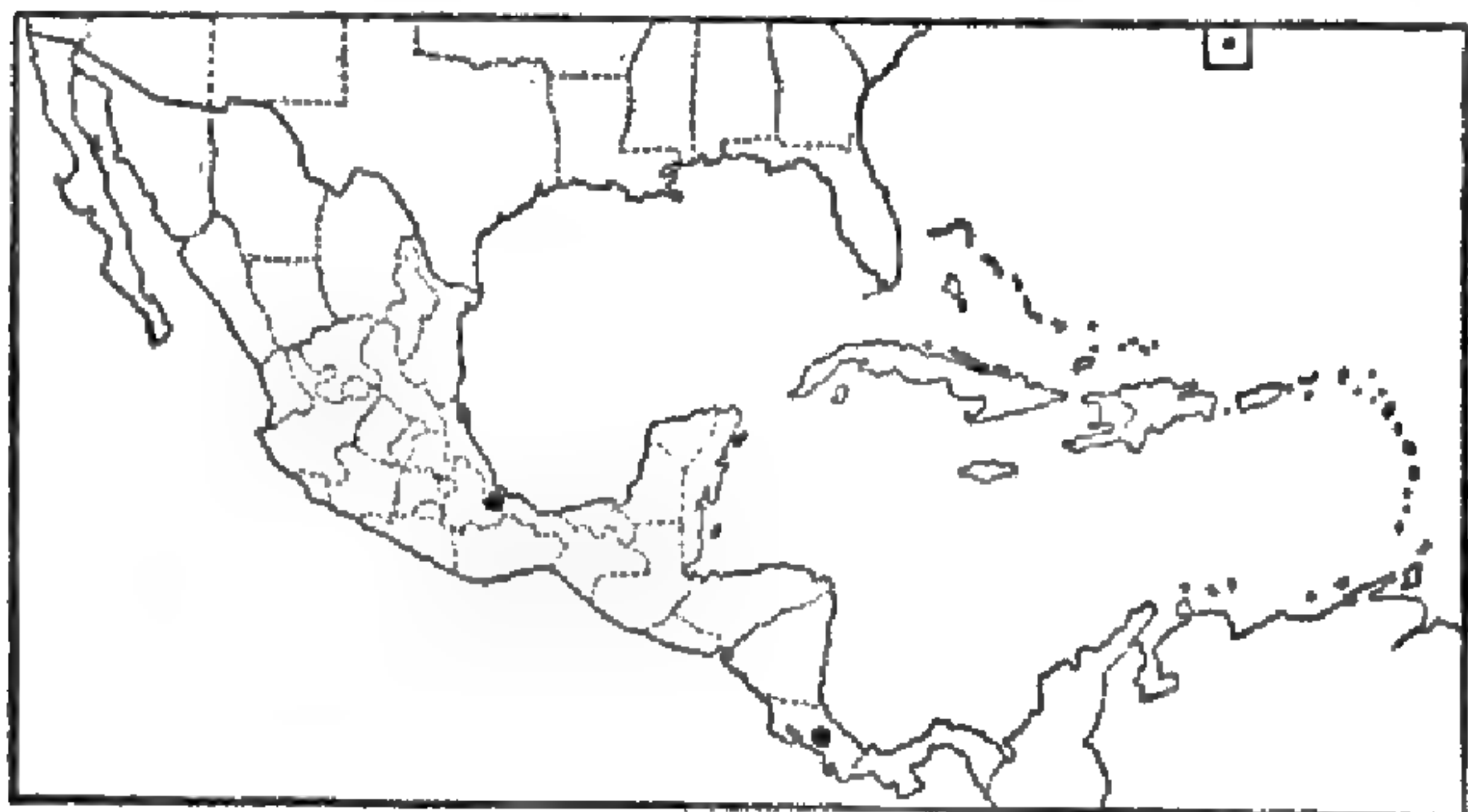


FIG. 89.—Distribution of *P. parviglume*.

#### DISTRIBUTION.

Banks and ditches, southern Mexico to Costa Rica. The type specimen from San José, Costa Rica.

VERACRUZ: Orizaba, *Bourgeau* 3197, *Müller* 2018. *Borrego*, *Botteri* 150, 152.

COSTA RICA: Alajuelita, *Jiménez* 403. San Francisco de  
Guadalupe, *Tonduz & Pittier* 8448, *Jiménez* 113. San José, *Hitchcock* 8487.

#### TRICHOIDIA.

- One of the two species of this group, *Panicum trichanthum*, is found to be a perennial. Blades more than one-fourth as wide as long; spikelets pubescent; plants annual..... 67. *P. trichoides*.  
Blades less than one-eighth as wide as long; spikelets minutely bullate-rugose; plants perennial..... 68. *P. trichanthum*.

#### 67. *Panicum trichoides* Swartz.

*Panicum trichoides* Swartz, Prodr. Veg. Ind. Occ. 24. 1788; Contr. U. S. Nat. Herb. 15: 129. 1910.

#### DISTRIBUTION.

Damp shady places, often a weed in fields and groves, tropical America. The type specimen from Jamaica.

SINALOA: Imala, *Palmer* 1758 in 1891.

TEPIC: María Madre Islands, *Nelson* 4257.

JALISCO: Guadalajara, *Amer. Gr. Nat. Herb.* 70, *Pringle* 2618, 3828.

COLIMA: Manzanillo, *Palmer* 1083 in 1890. Colima, *Orcutt* 4515. Alzada, *Hitchcock* 7110.

MICHOACÁN: La Correa, *Langlassé* 380. Hacienda Coahuayula, *Emrick* 53.

VERACRUZ: Zacuapán, *Purpus* 2902. Minatitlán, *Smith* 601. Córdoba, *Finck* in 1893. Sanborn, *Orcutt* 3241.

GUERRERO: Acapulco, *Palmer* 287 in 1894.

OAXACA: Guatulco, *Liebmann* 317.

TABASCO: Mayito, *Rovirosa* 434. San Juan Bautista, *Rovirosa* 598.

YUCATÁN: Izamal, *Gaumer* 522. San Anselmo, *Gaumer* 895, 2027.

<sup>1</sup> Contr. U. S. Nat. Herb. 15: 329. 1910.



BRITISH HONDURAS: Manatee Lagoon, *Peck* 314. Toledo, *Peck* 637 (both in Gray Herb.).

GUATEMALA: El Palmar, *Kellerman* 6263. Santa Rosa, *Heyde & Lux* 4299. Cubilquitz, *Türckheim* 7801. Morales, *Deam* 6041. Rinconcito, *Heyde & Lux* 4299.

HONDURAS: Amapala, *Hitchcock* 8768. Puerto Sierra, *Wilson* 89, 188.

SALVADOR: Sonsonate, *Hitchcock* 8981. San Salvador, *Velasco* 10. La Unión, *Hitchcock* 8791.

NICARAGUA: Jinotepe, *Hitchcock* 8693. San Juan del Sur, *Hitchcock* 8604. Masaya, *Hitchcock* 8631.

COSTA RICA: Hacienda de Zent, *Tonduz* 363, *Pittier* in 1904. Atenas, *Hitchcock* 8521. Puntarenas, *Hitchcock* 8555. Alajuela, *Jiménez* 145. San José, *Tonduz* 3133. Buenos Aires, *Tonduz* 4865, *Pittier* 3651. Matina, *Pittier* 9754. Nicoya, *Cooper* 10379, *Tonduz* 13754. Boruca, *Pittier* 4458. Hacienda de Chirripó, *Pittier* 16081. Carrillo, *Biolley* 3111.

PANAMA: Culebra, *Hitchcock* 7933, 8022. Alajuela, *Pittier* 2352. Puerto Obaldía, *Pittier* 4284. Below Chepo, *Pittier* 4696. Culebra, *Pittier* 2083. Tabernilla, *Hitchcock* 8384. Taboga Island, *Celestine* 84.

CUBA: Habana, *León* in 1910, *Curtiss* 714. Monte Verde, *Wright* 1538. Sancti Spiritus, *León* 4105.

JAMAICA: Ramble, *Hitchcock* 9475.

Cedar Hurst, *Harris* 11566.

Castleton, *Harris* 11299, 11328.

Kingston, *Hitchcock* 9281. Port Antonio, *Fredholm* 3282. Gordon Town, *Hitchcock* 9332.

PORTO RICO: Maricao, *Chase* 6191. Vega Baja, *Chase* 6417. Mayaguez, *Chase* 6167, *Sintenis* 160, *Cowell* 522, 583. Ponce, *Heller* 6094. Luquillo Mountains, *Wilson* 283. Martin Peña, *Heller* 387. Between Aibonito and Cayey, *Heller* 531. Mount Morales, *Britton & Cowell* 444. Santurce, *Heller* 157. Rio Piedras, *Barrett* 61.

LEEWARD ISLANDS: St. Kitts, *Britton & Cowell* 295. Guadeloupe, *Duss* 2681. Dominica, *Eggers* in 1881. Montserrat, *Shafer* 337, 706. Saba, *Suringar* in 1885, *Boldingh* 2122 (K. U. Herb.).

WINDWARD ISLANDS: Martinique, *Hahn* 1047, *Duss* 1321. Grenada, *Broadway* in 1905, *Eggers* 5987. St. Vincent, *Smith & Smith* 185 (K. U. Herb.).

TRINIDAD: Port of Spain, *Hitchcock* 9946.

VENEZUELA: Above Paparo, *Pittier* 6494. Tovar, *Fendler* 2499.

COLOMBIA: Santa Marta, *Smith* 167. Sevilla, *Pittier* 1621. Calí, *Pittier* 971.

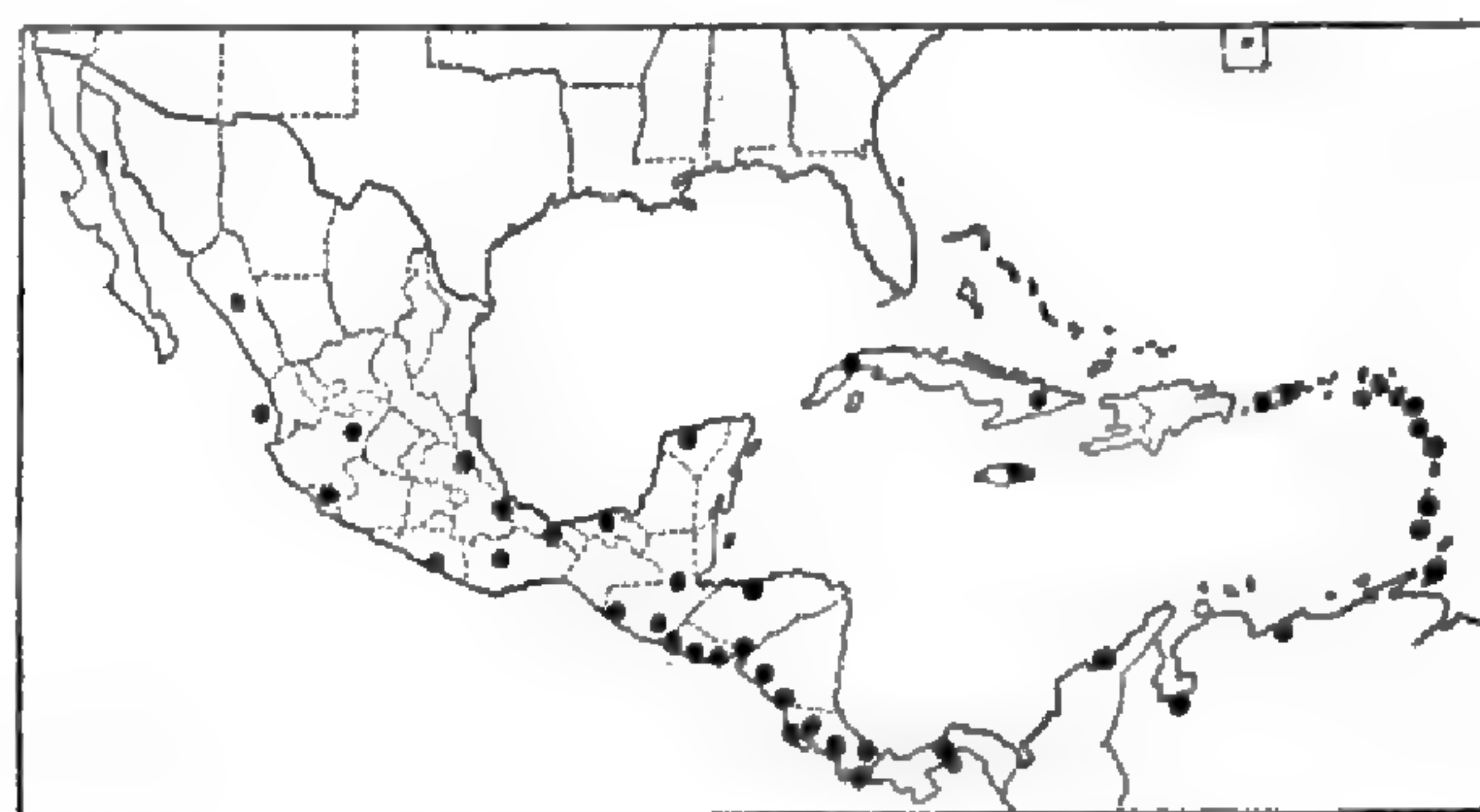


FIG. 90.—Distribution of *P. trichoides*.

### 68. *Panicum trichanthum* Nees.

*Panicum trichanthum* Nees, *Agrost. Bras.* 210. 1829; *Contr. U. S. Nat. Herb.* 15: 131. 1910.

The habit of this species as studied in the field indicates that it is a perennial. The culms are long and straggling with rootlets at the nodes and form a tangled mass among shrubs or vines.



## DISTRIBUTION.

Moist thickets and river banks, Mexico, and the West Indies to Paraguay. The type specimen from Mexico.

SAN LUIS POTOSÍ: San Luis Potosí to Tampico, *Palmer* 1151 in 1879.

COLIMA: *Palmer* 1257 in 1891.

VERACRUZ: Motzorongo, *Smith* 585. Veracruz, *Hitchcock* 6584. Jicaltepec, *Liebmann* 320. Colipa, *Liebmann* 432. Without locality, *Müller* 2172.

CAMPECHE: Near Champotón, *Collins* 37.

BRITISH HONDURAS: Tolédo, *Peck* 775 (Gray Herb.).

GUATEMALA: Gualán, *Deam* 424. Puerto Barrios, *Hitchcock* 9149. Morales, *Kellerman* 6272. Finca Trece Aguas, *Lewton* 377. Cubilquitz, *Türckheim* 7798.

HONDURAS: San Pedro Sula, *Thieme* 5587.

NICARAGUA: Jinotepe, *Hitchcock* 8669, 8682.

COSTA RICA: Port Limon, *Hitchcock* 8434. Talamanca, *Tonduz* 8600, 8670.

PANAMA: Laguna de Chiriquí, *Hart* 87. Culebra, *Hitchcock* 7895.

Frijoles, *Maxon* 4703. Panama, *Hitchcock* 9212. Tabernilla, *Pittier* 3824, *Hitchcock* 8383. Gamboa, *Pittier* 4798. Balboa, *Hitchcock* 8015.

CUBA: Trinidad, *Wright* 753. Vento, *Curtiss* 598, *León* 557. Romelie, *Eggers* 5350.

JAMAICA: Port Antonio, *Hitchcock* in 1890.

PORTO RICO: Cayey, *Sintenis* 2471, *Chase* 6748. Peñuelas, *Chase* 6487. Rio Piedras, *Johnston* 143.

TRINIDAD: Port of Spain, *Hitchcock* 9943. Cedros, *Hitchcock* 10146.

VENEZUELA: Tovar, *Fendler* 1443.

COLOMBIA: Santa Marta, *Smith* 2151.

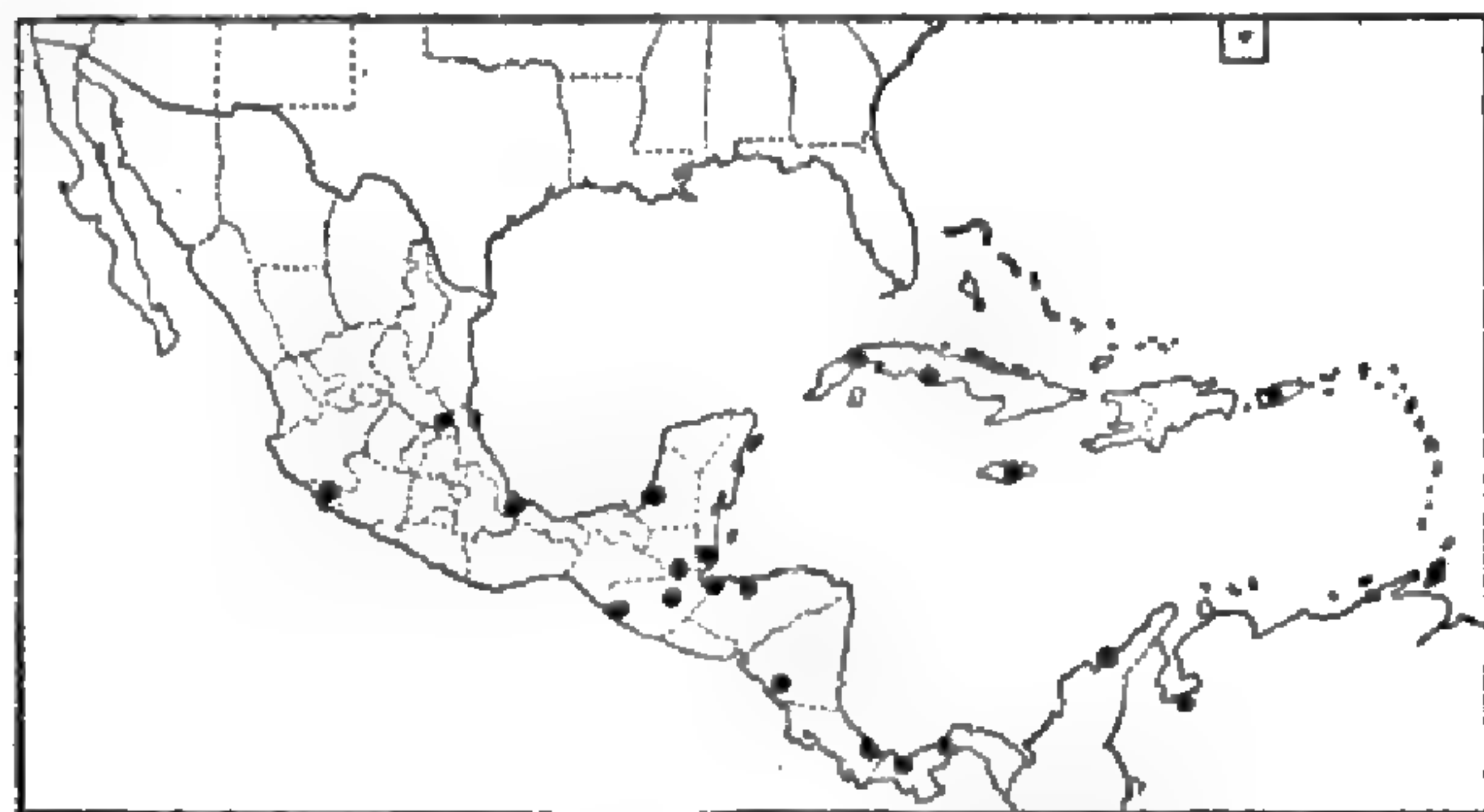


FIG. 91.—Distribution of *P. trichanthum*.

## PARVIFOLIA.

Perennials, usually glaucous; culms more or less decumbent; panicles small, diffuse, the spikelets small, turgid or subglobose, glabrous, the first glume more than half the length of the spikelet.

Culms very slender, decumbent or creeping; blades 1 to 3 cm.

long..... 69. *P. parvifolium*.

Culms firm, erect or decumbent at base only; blades 3 to 8 cm.

long..... 70. *P. cyanescens*.

69. *Panicum parvifolium* Lam.

*Panicum parvifolium* Lam. Tabl. Encycl. 1: 173. 1791; Contr. U. S. Nat. Herb. 15: 134. 1910.

The blades in this species vary in shape from oblong or ovate-lanceolate to narrowly lanceolate, in surface from glabrous to densely appressed-hirsute, and in texture from thin to firm. One form, in aspect approaching *P. cyanescens*, has firm pubescent erect blades, as much as 5 mm. wide and 4.5 cm. long. This is represented by *Broadway* 2372 in part and *Hitchcock* 10065, both from Trinidad. *Panicum brasiliense* Spreng. is a pubescent form with oblong-lanceolate moderately firm blades. It does not appear possible to recognize this form as a distinct species.



## DISTRIBUTION.

Wet savannas and margins of ponds and streams, Costa Rica and the West Indies to Paraguay. The type specimen from tropical America.

COSTA RICA: Buenos Aires, *Tonduz* 3631, 3659, *Pittier* 10594.

CUBA: Los Almacigos, *Wright* 3458. Herradura, *Baker* 2078, *Tracy* 9060, 9079, *Hitchcock* 181, *Britton*, *Earle & Gager* 6494. Pinar del Río, *Britton & Gager* 7075. Guane, *Shafer* 10659. Laguna Los Indios, *Shafer* 10803.

PORTO RICO: Lake Loisa, *Chase* 6786. Campo Alegre, *Chase* 6615, 6788. Aguada, *Sintenis* 5719. Guainabo, *Chase* 6630. Cataño, *Sintenis* 5719. Martin Peña, *Chase* 6358. Trujillo Alto, *Chase* 6763. Vega Baja, *Chase* 6796, *Heller* 1316.

TRINIDAD: Cumuto Station, *Hitchcock* 10065, *Amer. Gr. Nat. Herb.* 72. Pitch Lake, *Hitchcock* 10100. Arima, *Broadway* 2372. Without locality, *Crueger*, 224.



FIG. 92.—Distribution of *P. parvifolium*.

70. *Panicum cyanescens* Nees.

*Panicum cyanescens* Nees, *Agrost. Bras.* 220. 1829. "*Habitat in Brasilia meridionali (Sellow).*" The type is in the Berlin Herbarium.

*Panicum firmifolium* Trin.; Nees, loc. cit. A herbarium name given as a synonym of *P. cyanescens*.

## DESCRIPTION.

Plants perennial, bluish or glaucous; culms tufted, erect or with a decumbent base rooting at the nodes, slender, smooth, leafy, 30 to 50 cm. high, branching from the middle and upper nodes; sheaths striate, glabrous, rarely ciliate on the overlapping margin; ligule minute, membranaceous, sparsely ciliate with long hairs or sometimes naked; blades flat, rather firm, erect, spreading or reflexed, 3 to 8 cm. long, 4 to 5 mm. wide,

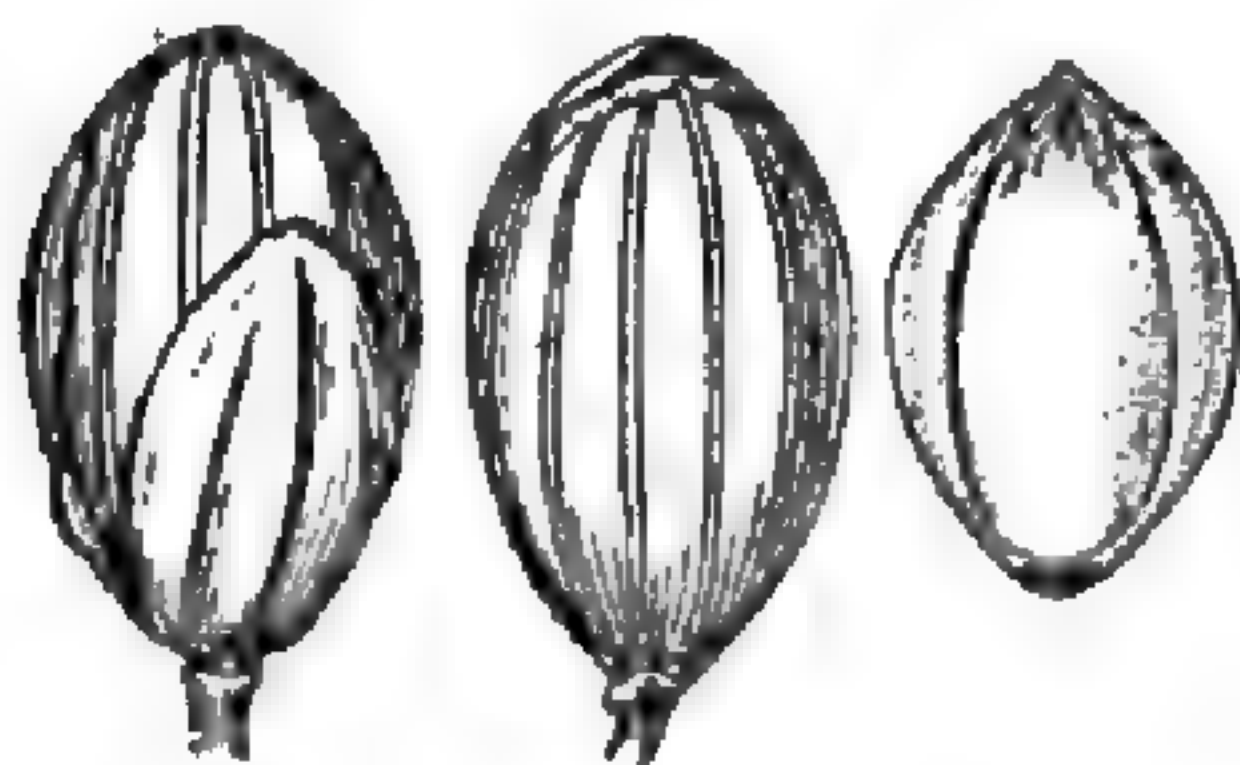


FIG. 93.—*P. cyanescens*.  
From type specimen.

oblong-lanceolate, slightly narrowed to the base, acute, glabrous; panicles short-exserted, terminal and often from the upper sheaths, 3 to 6 cm. long, as wide or wider, open, the slender flexuous branches rather remote, stiffly ascending or spreading, naked below, branching and spikelet-bearing toward the ends, the spikelets on slender divaricate pedicels; spikelets about 1.5 mm. long, 0.9 mm. wide, turgid or subglobose, obtuse, glabrous; first glume two-thirds to three-fourths as long as the spikelet; second glume and sterile

lemma equal, covering the fruit, or at maturity the glume wrinkled because of the turgidity of the fruit, exposing the summit; fruit 1.2 mm. long, 0.8 mm. wide, very turgid, subacute, the lemma and palea cellular-roughened as seen under a lens, bearing a few very obscure appressed hairs toward the summit.

This species resembles *P. parvifolium*, but differs in the less slender, more erect culms, longer blades, and stiffly ascending panicle branches, naked below.



FIG. 94.—Distribution of *P. cyanescens*.

## DISTRIBUTION.

Swamps and wet savannas, British Honduras and Trinidad to Brazil.

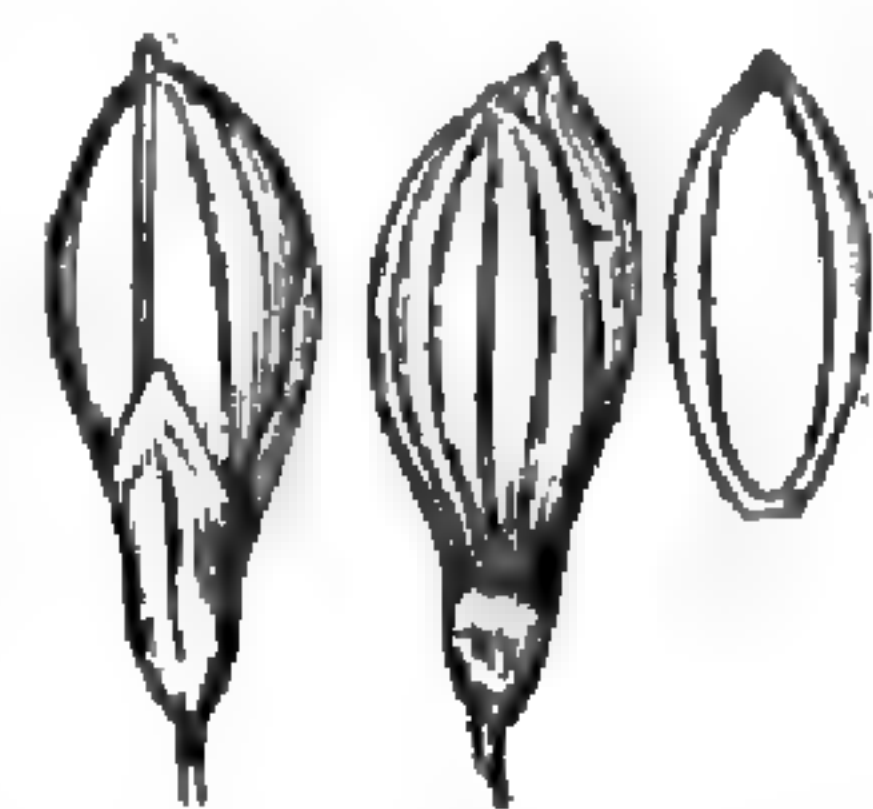
BRITISH HONDURAS: Manatee Lagoon, *Peck* 271 (Gray Herb.).

TRINIDAD: Piarco Savanna, *Hitchcock* 10349, 10354, 10364. Cumuto Station, *Hitchcock* 10067. Aripo Savanna, *Broadway* 2377.

## UNGROUPED SPECIES OF TRUE PANICUM.

71. *Panicum pyricularium* sp. nov.

Plants annual; culms delicate, 10 to 13 cm. high, at first erect and simple, finally decumbent and branching, often rooting at the nodes, more or less zigzag, sometimes elongating to 25 or 30 cm.; nodes sparsely pilose or glabrous; sheaths shorter than the blades, glabrous or sparsely pilose; ligule membranaceous, about 0.5 mm. long; blades thin, flat, spreading, 1 to 3 cm. long, 2 to 7 mm. wide (the lower sometimes smaller), narrowly elliptical, somewhat clasping at base, obtuse or acutish at the apex, scabrous on the margins, glabrous or sparsely pilose on both surfaces, sometimes glaucous; panicles terminating the culm and branches, loose and open, 2 to 5 cm. long, about as wide, oval or pyramidal in outline, the delicate flexuous branches and branchlets spreading or reflexed, smooth, the capillary divaricate pedicels several times longer than the spikelets; spikelets 1.5 mm. long, 0.6 mm. wide, turgid, pyriform, long-attenuate at base, glabrous; first glume about half as long as the spikelet, acute; second glume and sterile lemma 5-nerved, not exceeding the fruit, the glume slightly shorter than the sterile lemma; fruit 1 mm. long, 0.5 mm. wide, turgid.

FIG. 95.—*P. pyricularium*. From type specimen.

Type in the U. S. National Herbarium, no. 715639, collected between Hato del Jobo and Cerro Vaca, eastern Chiriquí, Panama, altitude 700 to 1,000 meters, December 25 to 28, 1911, by H. Pittier (no. 5416).

*Panicum pyricularium*, one of the smallest and most delicate species in the genus, is not related to any North American species.

The South American *Panicum polycomum* Trin. is an allied species of more tufted habit, with much narrower blades, smaller panicles, and smaller pubescent spikelets not attenuate at base.

None of the labels with the specimens cited below indicates the habitat.

FIG. 96.—Distribution of *P. pyricularium*.

## DISTRIBUTION.

Panama to Venezuela.

PANAMA: Between Hato del Jobo and Cerro Vaca, Chiriquí, *Pittier* 5416.

VENEZUELA: Tovar, *Fendler* 2502.

COLOMBIA: Santa Marta, *Smith* 2570. Without locality, *Trinana* 281 (2811?).



72. *Panicum haenkeanum* Presl.

*Panicum haenkeanum* Presl, Rel. Haenk. 1: 304. 1830. "Hab. in Mexico." The type specimen is in the herbarium of the National Museum at Prague. The only datum on the label is the word "Mexico."

*Panicum costaricense* Hack. Oesterr. Bot. Zeitschr. 51: 428. 1901; Contr. U. S. Nat. Herb. 15: 134. 1910.

For discussion of *Panicum expansum* Fourn., mentioned in the Revision under *P. costaricense*, see page 525 under *P. cordovense*.

Field study of this species shows that it is a perennial with straggling culms as much as 2 meters long, often rooting at the lower nodes.

## DISTRIBUTION.

Moist wooded or grassy banks and slopes, Mexico to Panama.

COSTA RICA: Térraba, *Tonduz* 3628, 3636, 3673. Boruca, *Pittier* 4626. Cordoncillal, *Pittier* 3640. Buenos Aires, *Tonduz* 3687, 4860, *Pittier* 3661.

PANAMA: Culebra, *Hitchcock* 9168. Between Corozal and Ancon, *Pittier* 2169, 2636. San Felix, *Pittier* 5247. Between Panama and Corozal, *Hitchcock* 9206.



FIG. 97.—Distribution of *P. haenkeanum*.

73. *Panicum ineptum* sp. nov.

## DESCRIPTION.

Plants perennial (?); culms slender, apparently ascending, probably 50 cm. or more long, slender, striate-fluted, glabrous or the upper internodes sparsely pilose,

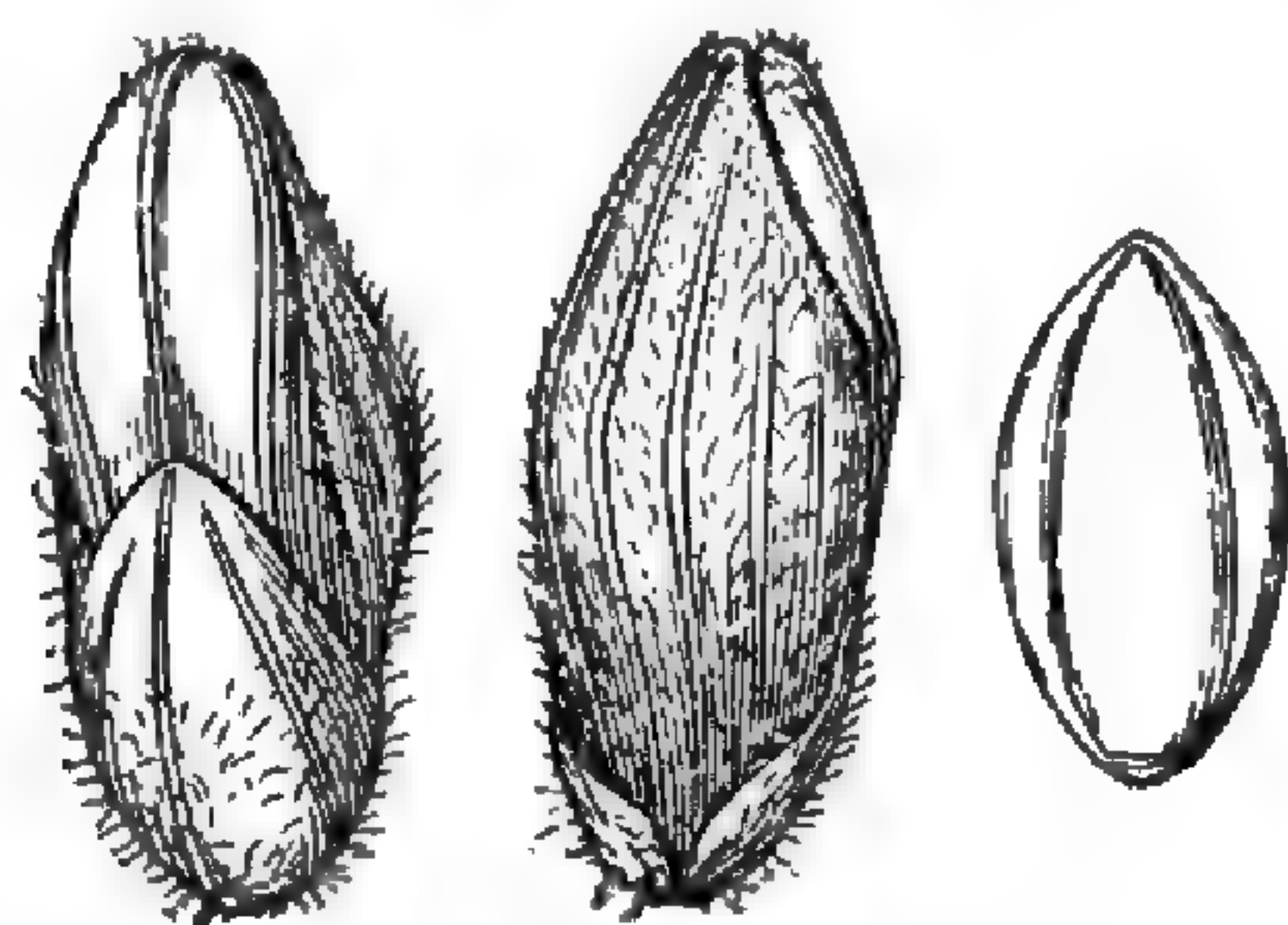


FIG. 98.—*P. ineptum*. From type specimen.

producing nearly simple branches as much as 25 cm. long; nodes retrorsely pubescent; sheaths loose, shorter than the internodes, pilose, the margins densely ciliate; ligule ciliate, about 0.5 mm. long; blades spreading, flat, 3 to 7 cm. long, 3 to 6 mm. wide, tapering from the truncate base to an acuminate apex, softly pilose on both surfaces; panicles terminal, those of the branches short-exserted, 3 to 5 cm. long, consisting of few to several short spreading densely flowered branches, remote along the slender pilose axis, the branches 4 to 6 mm.

long, bearing 1 to 8 subsessile spikelets, the rachis pilose; spikelets 2.5 to 2.7 mm. long, 1.1 mm. wide, blunt; first glume about half as long as the spikelet, 3-nerved, obtuse, pubescent; second glume and sterile lemma equal, inflated, much larger than the fruit, the glume gibbous in the middle, 7-nerved, pubescent, the sterile lemma 3-nerved, glabrous, inclosing a membranaceous palea; fruit 1.6 mm. long, 0.9 mm. wide, elliptical, smooth and shining, the lemma strongly convex.

Type in the herbarium of Krug & Urban in the Berlin Botanical Museum, the ticket reading "817 Panicum—S. Domingo, Bertero. Hb. Spr." A slip in Sprengel's hand bears the name "*Panicum nemorosum* Sw." [*Ichnanthus nemorosus*].



FIG. 99.—Distribution of *P. ineptum*.



The type specimen, consists of a culm with four internodes, the base and summit wanting, bearing two flowering branches. No other collection of the species is known. It appears to be related to *Panicum venesuelae* Hack., from which it differs in the smaller panicle and in the smaller and pubescent instead of bristly hispid spikelets.

#### 74. *Panicum millegrana* Poir.

*Panicum millegrana* Poir. in Lam. Encycl. Suppl. 4:278. 1816; Contr. U. S. Nat. Herb. 15:135. 1910.

*Panicum patentissimum* Desv.; Poir. in Lam. Encycl. Suppl. 4:283. 1816. "Cette plante croît à Saint-Dominique & à la Nouvelle-Espagne." The type from the herbarium of Desvaux in the Paris Herbarium is a fragmentary specimen consisting of a panicle with immature glabrous spikelets together with a few broken leaves.

##### DISTRIBUTION.

Damp woods and shady banks, Mexico and the West Indies to Paraguay. The type specimen from tropical America, probably from Cayenne.

VERACRUZ: Córdoba, *Amer. Gr. Nat. Herb.* 73. Jalapa, *Hitchcock* 6605, *Holway* 3083. Mirador, *Liebmann* 275.

OAXACA: Without locality, *Galeotti* 5728.

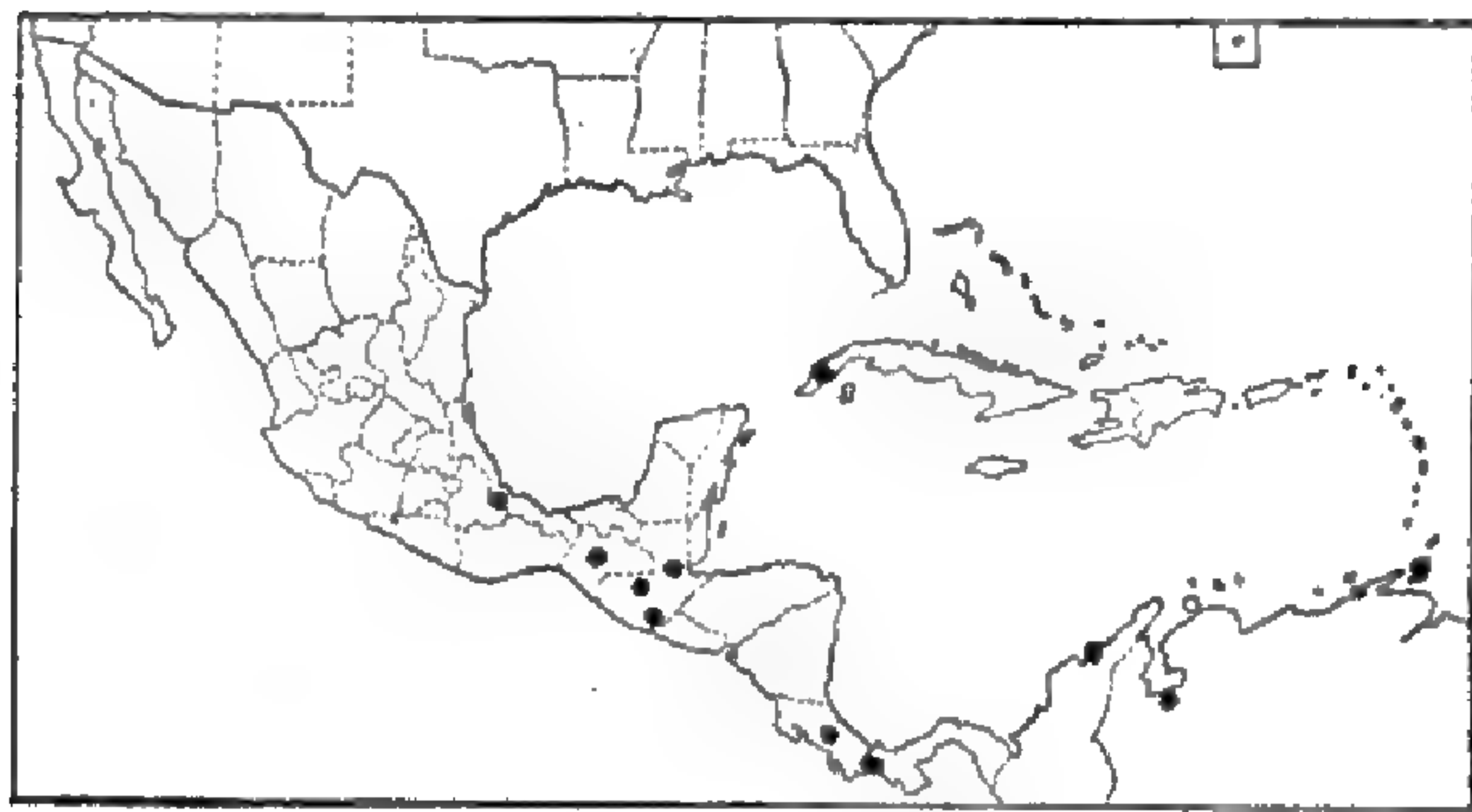


FIG. 100.—Distribution of *P. millegrana*.

*Wright* 3455. Pinar del Río, *Wright* 3855. Sumidero, *Shafer* 13562. Sierra de Cabra, *Britton & Gager* 7201.

TRINIDAD: Pitch Lake, *Hitchcock* 10087. Port of Spain, *Hitchcock* 9979.

VENEZUELA: Tovar, *Fendler* 1641.

COLOMBIA: Santa Marta, *Smith* 168, 2146.

CHIAPAS: Santa Rosa, *Heyde & Lux* 3927.

GUATEMALA: Cubilquitz, *Türckheim* 8783, 8784. Cobán, *Türckheim* 657. Guatemala City, *Hitchcock* 9056.

COSTA RICA: El General, *Pittier* 10615.

PANAMA: El Boquete, *Hitchcock* 8299.

CUBA: Herradura, *Hitchcock* 180, *Tracy* 9098. La Catalina,

#### 75. *Panicum glutinosum* Swartz.

*Panicum glutinosum* Swartz, Prodr. Veg. Ind. Occ. 24. 1788; Contr. U. S. Nat. Herb. 15:138. 1910.

##### DISTRIBUTION.

Mountain woods, throughout tropical America. The type specimen from Jamaica.

VERACRUZ: Mirador, *Liebmann* 428, *Ross* 701. Orizaba, *Bourgeau* 3192, *Botteri*. Jalapa, *Amer. Gr. Nat. Herb.* 74. Zacuapán, *Purpus* 2156, 2903.



FIG. 101.—Distribution of *P. glutinosum*.



CHIAPAS: Turubula, *Nelson* 3357.

COSTA RICA: Helechales del General, *Pittier* 12002. Cañas Gordas, *Pittier* 11017. Cabagra, *Tonduz* 6547. Río Birris, *Pittier* 3118.

CUBA: Loma Pelada, *Wright* 757. La Perla, *León* 3790. Banao Hills, *León* 3998. Gran Piedra, *Shafer* 9014. Without locality, *Linden* 2143.

JAMAICA: Gordon Town, *Hart* 792, *Hitchcock* 9321. Troy, *Maxon* 2816, *Hitchcock* 9785. Abbey Green, *Hitchcock* 9370. Cinchona, *Hitchcock* 9708, *Harris* 11264, 11440, 11508. Ewarton, *Hitchcock* 9451. Ipswich, *Hitchcock* 9627. Newport, *Britton* 3193. Road to Salt Hill, *Harris* 11395. Without locality, *Wulfschlaegel* 1163.

HAITI: Kenskoff, *Buch* 956.

SANTO DOMINGO: *Picarda* 620 (K. U. Herb.).

PORTO RICO: Sierra de Yabucoa, *Sintenis* 2609, Mayaguez, *Sintenis* 357. Alto de Bandera, *Chase* 6469. Maricao, *Chase* 6199, 6250.

VENEZUELA: Caracas, *Pittier* 5910.

#### 76. *Panicum rudgei* Roem. & Schult.<sup>1</sup>

*Panicum rudgei* Roem. & Schult. Syst. Veg. 2: 444. 1817; Contr. U. S. Nat. Herb. 15: 139. 1910.

##### DISTRIBUTION.

Savannas, Jamaica and British Honduras to Brazil. The type specimen from British Guiana.

BRITISH HONDURAS: Monkey River, *Peck* 588 (Gray Herb.).

COSTA RICA: Buenos Aires, *Pittier* 10576, *Tonduz* 3679, 4875.

Los Palmares, *Pittier* 10588.

Helechales del General, *Pittier* 12064.

JAMAICA: Bunkers Hill Savanna, *Harris* 11170.

TRINIDAD: Pitch Lake, *Amer. Gr. Nat. Herb.* 75. St. Joseph, *Hitchcock* 10181. Without locality, *Crueger*.



FIG. 102.—Distribution of *P. rudgei*.

#### 77. *Panicum megiston* Schult.

*Panicum megiston* Schult. Mant. 2: 248. 1824; Contr. U. S. Nat. Herb. 15: 141. 1910.

##### DISTRIBUTION.

Swamps, Mexico and Cuba to Paraguay. The type specimen from British Guiana.

TABASCO: San Juan Bautista, *Ro-virosa* 532.

COSTA RICA: Guanacaste, *Jiménez* 727.

PANAMA: Empire, *Pittier* 3726. Bohío, *Amer. Gr. Nat. Herb.* 76.

CUBA: Santa Cruz de los Piños, *Wright* 3872.

TRINIDAD: Caroní Savanna, *Hart* 4197. Without locality, *Crueger*.

VENEZUELA: Santa Catalina, *Rusby & Squires* 355.

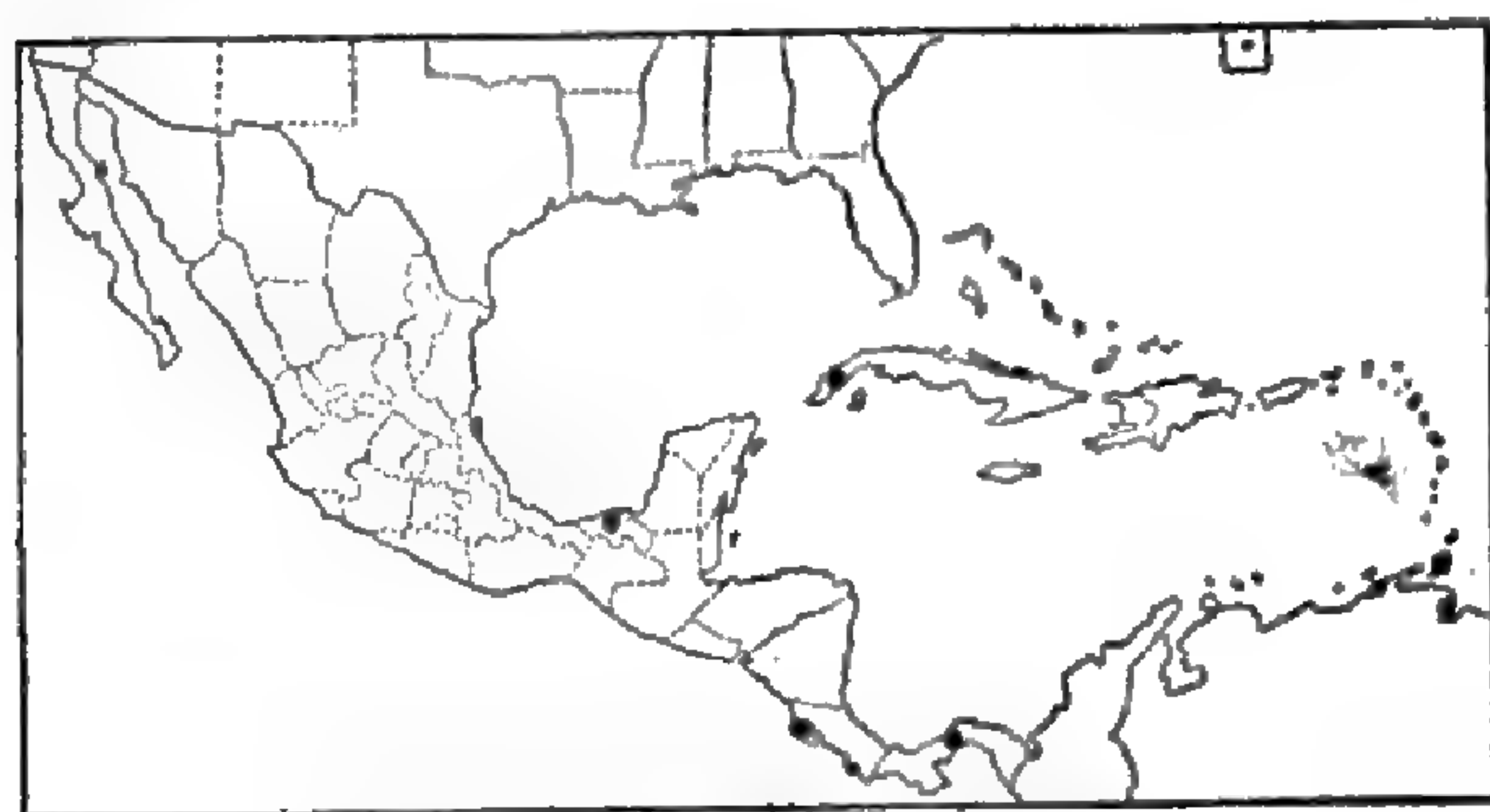


FIG. 103.—Distribution of *P. megiston*.

<sup>1</sup> The South American species described as *Panicum rotundum* Hitchc. & Chase (Contr. U. S. Nat. Herb. 15: 139. 1910) proves to be the same as *Panicum campestre* Nees (Trin. Gram. Pan. 197. 1826).



*Panicum trigonum* Retz.,<sup>1</sup> an East Indian perennial with low creeping and branching culms and spreading pilose blades 2 to 4 cm. long, contracted panicles of short-pediceled hispidulous spikelets about 1.7 mm. long, the second glume keeled, the fruit slightly compressed laterally, has been found "under the shade of a shrub," Port of Spain, Trinidad, *Broadway* 4891.

**Subgenus DICHANTHELIUM** Hitchc. & Chase.

- Foliage soft and lax, the flat blades prominently ciliate;  
plants branching from the base, finally forming ro-  
settes or cushions. . . . . See *LAXIFLORA*, p. 513.
- Foliage not soft and lax; plants branching from the culm  
nodes.  
First glume nearly as long as the spikelet. . . . . See *CORDOVENSIA*, p. 525.  
First glume much shorter than the spikelet.  
Spikelets glabrous; plants glabrous throughout;  
autumnal form erect, not bushy-branching. See *DICHOTOMA*, p. 516.  
Spikelets pubescent.  
Sheaths glabrous or minutely puberulent  
only; ligules minute or obsolete.  
Spikelets attenuate at base, mostly  
prominently pustulose; blades  
narrow, stiff, strongly nerved, ta-  
pering from base to apex. . . . . See *ANGUSTIFOLIA*, p. 514.  
Spikelets not attenuate at base, not pus-  
tulose.  
Spikelets subglobose or pyriform.  
Blades spreading, rarely over 5  
cm. long and 5 mm.  
wide, spikelets pyriform;  
autumnal form bushy-  
branching . . . . . See *LANCEARIA*, p. 522.  
Blades erect, 7 to 13 cm. long,  
7 to 14 mm. wide; spike-  
lets spheroid . . . . . See *SPHAEROCARPA*, p. 521.  
Spikelets not subglobose nor pyri-  
form.  
Spikelets 2.8 mm. or more long. See *COMMUTATA*, p. 524.  
Spikelets not over 2 mm. long.  
Blades with a cartilaginous  
white margin; spike-  
lets not over 1.5 mm.  
long . . . . . 101. *P. albomarginatum*.  
Blades not white-margined;  
spikelets 2 mm. long. See *DICHOTOMA*, p. 516.  
Sheaths pubescent.  
Spikelets 4 mm. long, pyriform. . . . . 104. *P. nodatum*.  
Spikelets not over 2.6 mm. long.  
Spikelets attenuate at base, mostly  
prominently pustulose; blades  
narrow, stiff, strongly nerved,  
tapering from base to apex;  
autumnal form often bushy-  
branched. . . . . See *ANGUSTIFOLIA*, p. 514.

<sup>1</sup>Obs. Bot. 3: 9. 1783.



- Spikelets not attenuate at base.
  - Culms tall, usually 75 cm. high or more; foliage velvety-pubescent..... See SCOPARIA, p. 523.
- Culms not over 50 cm. high.
  - Spikelets not over 1.3 mm. long; sheaths and culms appressed-pubescent..... See SPRETA, p. 518.
- Spikelets 1.7 to 2.4 mm. long; plants conspicuously pubescent, at least on the sheaths. See LANUGINOSA, p. 519.

LAXIFLORA.

- Spikelets papillose-pilose; sheaths retrorsely pilose..... 78. *P. xalapense*.
- Spikelets glabrous; sheaths not retrorsely pilose.
  - Blades glabrous on the surface..... 79. *P. polycaulon*.
  - Blades pilose on the surface..... 80. *P. strigosum*.

78. *Panicum xalapense* H. B. K.

*Panicum xalapense* H. B. K. Nov. Gen. & Sp. 1: 103. 1816; Contr. U. S. Nat. Herb. 15: 159. 1910.

DISTRIBUTION.

Moist banks and rich woods, southeastern United States to Guatemala; also Santo Domingo. The type specimen from Jalapa.

- HIDALGO: Trinidad Iron Works, Pringle 13250.
- PUEBLA: Chinantla, Liebmann 328.
- VERACRUZ: Jalapa, Pringle 8083, Hitchcock 6587, Amer. Gr. Nat. Herb. 84, Smith 1752. Córdoba, Bourgeau 2162. Boca del Monte, Nelson 201, Seler 2160.
- GUATEMALA: Cobán, Türckheim 3831.
- SANTO DOMINGO: Constanza, Türckheim 3059. Río Yaqui near Jarabacoa, Eggers 2129.



FIG. 104.—Distribution of *P. xalapense*.

79. *Panicum polycaulon* Nash.

*Panicum dichotomum*  $\beta$  *glabrescens* Griseb. Fl. Brit. W. Ind. 553. 1864. “*Pd.* [Purdie], in mountain-savannahs [Jamaica].” The type specimen is in the Kew Herbarium.

*Panicum polycaulon* Nash, Bull. Torrey Club 24: 200. 1897; Contr. U. S. Nat. Herb. 15: 163. 1910.



## DISTRIBUTION.

Open moist woods and savannas, Florida and the Greater Antilles. The type specimen from Florida.

FIG. 105.—Distribution of *P. polycaulon*.

CUBA: Sierra Nipe near Woodfred, *Shafer* 3083. Herradura, *Hitchcock* 115. Isle of Pines, *Palmer & Riley* 990. Without locality, *Wright* 3875 in part.

JAMAICA: Hills back of Barican, *Hitchcock* 9561. Bull Head Mountain, *Hitchcock* 9550.

PORTO RICO: Aguada, *Sintenis* 5724. Monte Mesa, *Chase* 6276.

Trujillo Alto, *Chase* 6767. Campo Alegre, *Chase* 6621.

80. *Panicum strigosum* Muhl.

*Panicum strigosum* Muhl. in Ell. Bot. S. C. & Ga. 1: 126. 1816; Contr. U. S. Nat. Herb. 15: 164. 1910.

## DISTRIBUTION.

Sandy woods and open moist ground, southeastern United States to Colombia and in the Greater Antilles. Type specimen from South Carolina or Georgia.

VERACRUZ: Minatitlán, *Smith* 555.

GUATEMALA: Road from Gualán to Copán, *Pittier* 1800. Secanquím, *Pittier* 257.

COSTA RICA: Between De Candelaria and San Cristobal, *Jiménez* 459.

CUBA: El Guama, *Palmer & Riley* 213. Without locality, *Wright* 3875 in part.

JAMAICA: Bull Head Mountain, *Hitchcock* 9551.

SANTO DOMINGO: Without locality, *Eggers* 2045 (K. U. Herb.).

COLOMBIA: Santa Marta, *Smith* 163.

FIG. 106.—Distribution of *P. strigosum*.

## ANGUSTIFOLIA.

- Nodes bearded; plants grayish-villous; autumnal blades flat, rather soft. . . . . 82. *P. chrysopsidifolium*.
- Nodes not bearded; plants villous only at base, or nearly glabrous; autumnal blades involute.
- Spikelets 3 to 3.5 mm. long, pointed. . . . . 83. *P. fusiforme*.
- Spikelets less than 3 mm. long, not pointed or obscurely so.
- Plants glabrous or nearly so; autumnal culms erect.
- Spikelets subsecund along the suberect panicle branches. . . . . 86. *P. neuranthum*.
- Spikelets not subsecund; panicle loose and open. . . . . 85. *P. ovinum*.
- Plants pubescent, at least on the lower half.
- Spikelets about 2.4 mm., rarely only 2.1 mm., long; vernal blades 7 to 12 cm. long; autumnal blades not falcate. . . . . 84. *P. arenicoloides*.
- Spikelets not over 2 mm. long; vernal blades 4 to 6 cm. long; autumnal blades much crowded, falcate. . . . . 81. *P. aciculare*.



### 81. *Panicum aciculare* Desv.

*Panicum aciculare* Desv.; Poir. in Lam. Encycl. Suppl. 4: 274. 1816; Contr. U. S. Nat. Herb. 15: 166. 1910.

In the discussion of the type specimen it is stated that it probably came from the southeastern United States. As the species is now known to occur in Porto Rico, it becomes probable that this island is the type locality, since Desvaux described many species from there.

#### DISTRIBUTION.

Grassy slopes and sandy woods, southeastern United States, Cuba, and Porto Rico.

CUBA: Pinar del Río, *Britton & Gager* 7064. Sierra Nipe, *Shafer* 2968. Laguna Jovero, *Shafer* 10733, 10873. Without locality, *Wright* 3454, 3461.

PORTO RICO: Monte Mesa, *Chase* 6273. Campo Alegre, *Chase* 6624.

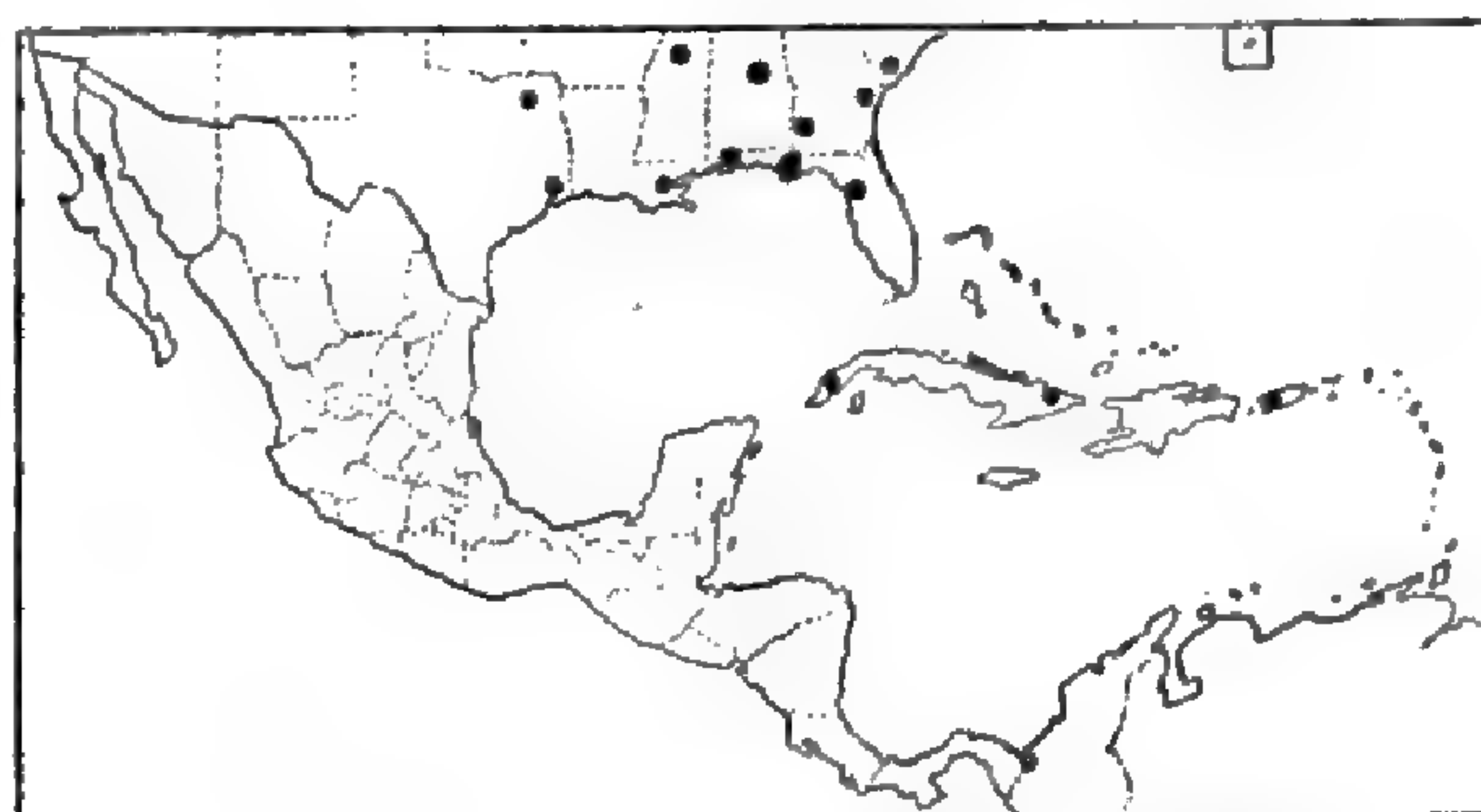


FIG. 107.—Distribution of *P. aciculare*.

### 82. *Panicum chrysopsidifolium* Nash.

*Panicum chrysopsidifolium* Nash in Small, Fl. Southeast. U. S. 100. 1903; Contr. U. S. Nat. Herb. 15: 168. 1910.

#### DISTRIBUTION.

Sandy woods and open moist ground, Florida, Louisiana, and the Greater Antilles. The type specimen from Florida.



FIG. 108.—Distribution of *P. chrysopsidifolium*.

CUBA: Consolación del Sur, *Palmer & Riley* 481. Isle of Pines, *Palmer & Riley* 982. Herradura, *Hitchcock* 116.

JAMAICA: Pedro Morass, *Harris* 11163. Bull Head Mountain, *Amer. Gr. Nat. Herb.* 89.

PORTO RICO: Las Marias, *Sintenis* 5985. Trujillo Alto, *Chase* 6766. Santurce, *Heller* 982.

HAITI: Without locality, *Christ* 1744 (K. U. Herb.).

SANTO DOMINGO: Without locality, *Bertero* 818 (K. U. Herb.).

### 83. *Panicum fusiforme* Hitchc.

*Panicum fusiforme* Hitchc. Contr. U. S. Nat. Herb. 12: 222. 1909; 15: 172. 1910.

#### DISTRIBUTION.

Sandy pine woods and open moist ground, Florida, Cuba, Jamaica, and British Honduras. The type specimen from Cuba.

BRITISH HONDURAS: Manatee Lagoon, *Peck* 453a (Gray Herb.).

CUBA: Herradura, *Hitchcock* 117, *Caldwell & Baker* 7139, *Tracy* 9074. Nueva Gerona, *Curtiss* 406. Western Cuba, *Wright* 3453, 3454.

JAMAICA: Bull Head Mountain, *Hitchcock* 9552.

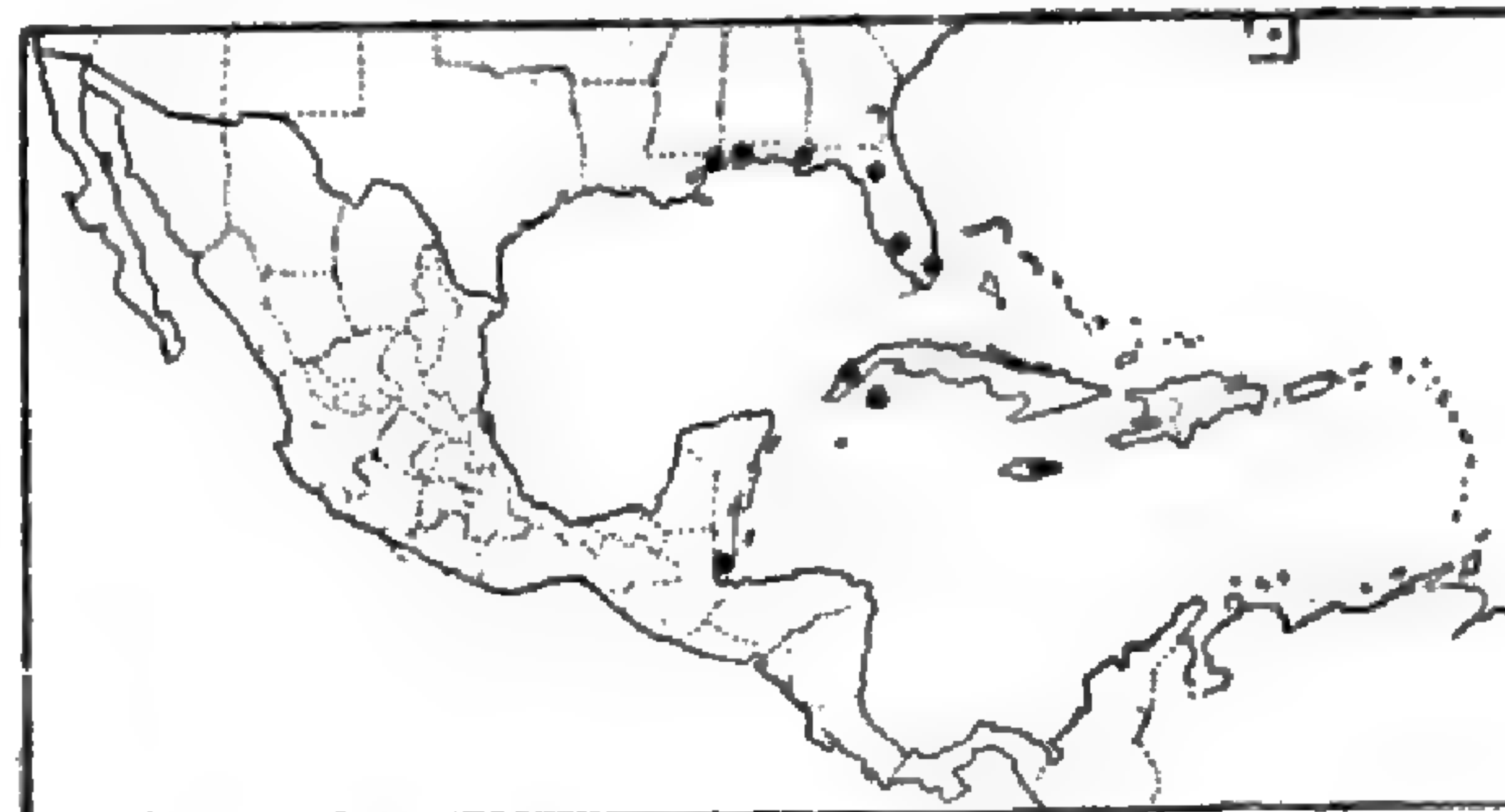


FIG. 109.—Distribution of *P. fusiforme*.



84. *Panicum arenicoloides* Ashe.

*Panicum arenicoloides* Ashe, Journ. Elisha Mitchell Soc. 16: 89. 1900; Contr. U. S. Nat. Herb. 15: 173. 1910.



FIG. 110.—Distribution of *P. arenicoloides*.

DISTRIBUTION.

Sandy pine woods, southeastern United States; also in Guatemala. The type specimen from North Carolina.

GUATEMALA: Cuesta de Peinha, between Gualán and Copán, Pittier 1805b.

85. *Panicum ovinum* Scribn. & Smith.

*Panicum ovinum* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Circ. 16: 3. 1899, Contr. U. S. Nat. Herb. 15: 174. 1910.

DISTRIBUTION.

Open prairie and meadows, Southern States and in Veracruz. The type specimen from Texas.

VERACRUZ: Hacienda de la Laguna, near Jalapa, Schiede (Berlin Herb.).



FIG. 111.—Distribution of *P. ovinum*.

86. *Panicum neuranthum* Griseb.

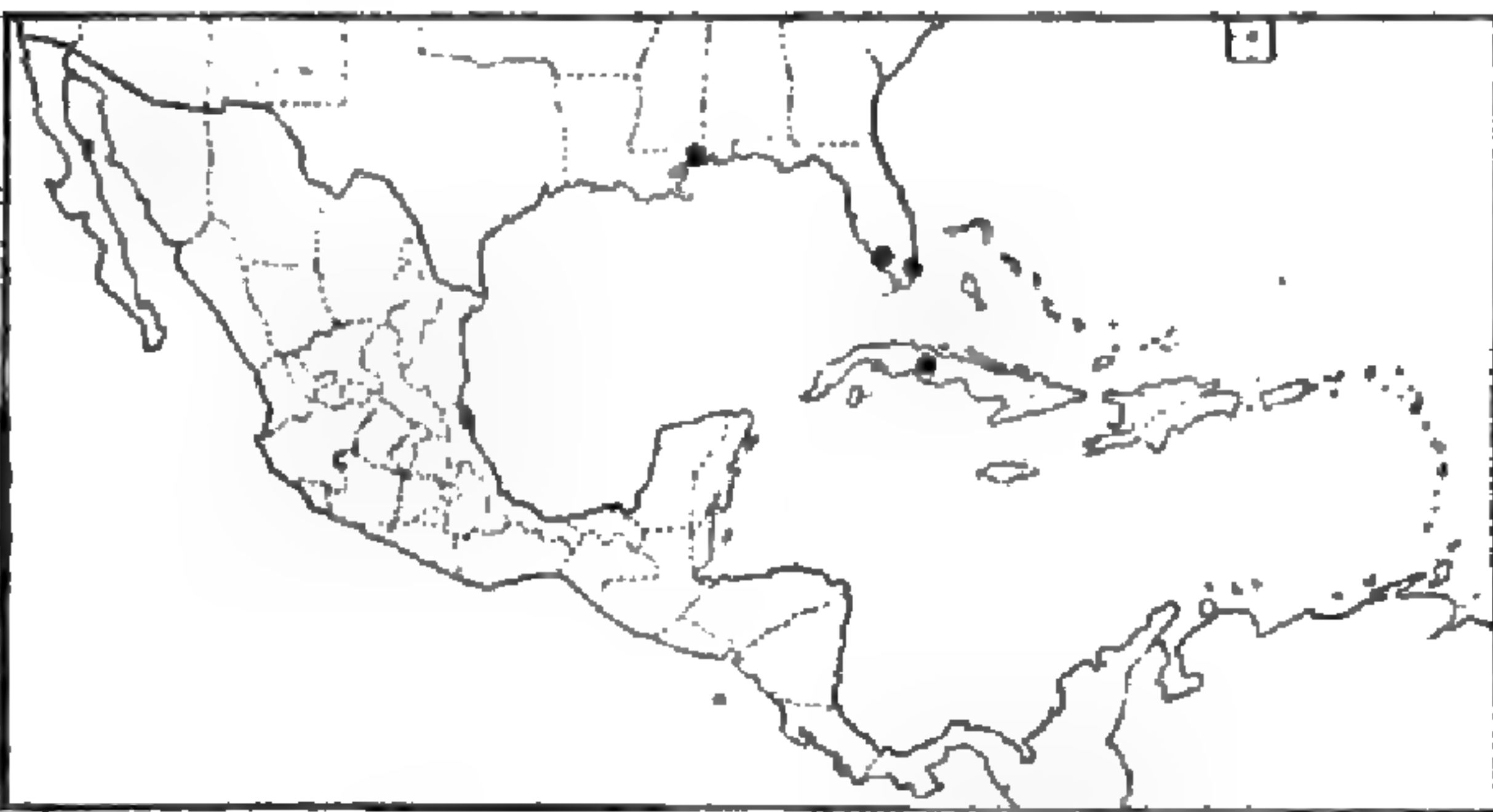


FIG. 112.—Distribution of *P. neuranthum*.

*Panicum neuranthum* Griseb. Cat. Pl. Cub. 232. 1866; Contr. U. S. Nat. Herb. 15: 175. 1910.

DISTRIBUTION.

Moist savannas, Florida and Cuba. The type specimen from Cuba.

CUBA: Hanábana, Wright 3453 in part. Without locality, Wright 3454a.

DICHOTOMA.

- Nodes, at least the lower, bearded; spikelets pubescent.
  - Fruit slightly exposed at maturity; upper sheaths viscid-spotted; autumnal form erect or reclining. . . . . 87. *P. nitidum*.
  - Fruit covered at maturity; sheaths not viscid-spotted; autumnal form decumbent, with flabellate-fascicled branches. . . . . 88. *P. multirameum*.
- Nodes not bearded; spikelets glabrous.
  - Spikelets not over 1.6 mm. long; panicles narrow; plants glaucous bluish green. . . . . 91. *P. caerulea*.



- Spikelets 2 mm. or more long; panicles open.  
Blades erect, firm; spikelets turgid, strongly nerved;  
plants grayish olive green; spikelets turgid,  
blunt..... 90. *P. roanokense*.  
Blades spreading; spikelets not turgid, 2.2 mm. or more  
long, pointed; sheaths bearing pale glandular  
spots..... 89. *P. yadkinense*.

87. *Panicum nitidum* Lam.

*Panicum nitidum* Lam. Tabl. Encycl. 1: 172. 1791; Contr. U. S. Nat. Herb. 15: 183. 1910.

DISTRIBUTION.

Moist ground and wooded swamps, southeastern United States, Bahamas, and Cuba. The type specimen from [South?] Carolina.

- BAHAMAS: Great Bahama, Golden Grove, Britton & Millspaugh 2736.  
CUBA: Sierra Nipe, Shafer 2999, 3001.



FIG. 113.—Distribution of *P. nitidum*.

88. *Panicum multirameum* Scribn.

*Panicum multirameum* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 19: 2. 1900; Contr. U. S. Nat. Herb. 15: 185. 1910.



FIG. 114.—Distribution of *P. multirameum*.

DISTRIBUTION.

Banks and dry open ground, southern Mexico to Guatemala; also in Jamaica. The type specimen from Jalapa.

- VERACRUZ: Orizaba, Bourgeau 2383, Smith 593, Amer. Gr. Nat. Herb. 98. Jalapa, Hitchcock 6610, 6639, Pringle 7882, 8339a, 9209, 9210.

- GUATEMALA: Cobán, Türckheim II. 1322.  
JAMAICA: Bull Head Mountain, Hitchcock 9532.

89. *Panicum yadkinense* Ashe.

*Panicum yadkinense* Ashe, Journ. Elisha Mitchell Soc. 16: 85. 1900; Contr. U. S. Nat. Herb. 15: 195. 1910.

DISTRIBUTION.

Moist woods and thickets, southeastern United States to Mexico. The type specimen from North Carolina.

- PUEBLA: Without locality, Nicolas in 1909.



FIG. 115.—Distribution of *P. yadkinense*.



90. *Panicum roanokense* Ashe.

*Panicum roanokense* Ashe, Journ. Elisha Mitchell Soc. 15: 44. 1898; Contr. U. S. Nat. Herb. 15: 196. 1910.



FIG. 116.—Distribution of *P. roanokense*.

## DISTRIBUTION.

Open swampy woods and wet meadows, Virginia to Texas; also in Jamaica. The type specimen from North Carolina.

JAMAICA: Bull Head Mountain, Hitchcock 9530.

91. *Panicum caerulescens* Hack.

*Panicum caerulescens* Hack.; Hitchc. Contr. U. S. Nat. Herb. 12: 219. 1909; 15: 197. 1910.

## DISTRIBUTION.

Marshes and swampy woods, New Jersey to Florida and Mississippi, Bahamas and Cuba. The type specimen from Florida.

BAHAMAS: Great Bahama, *Brace* 3524, *Britton & Millspaugh* 2506, 2668. Andros, *Brace* 7015 (all in Field Mus. Herb.). New Providence, *Britton & Brace* 597, 599, *Millspaugh* 2182, *Northrup* 248, *Eggers* 4305 (Hackel Herb.), *Eggers* 4312 (K. U. Herb.).

CUBA: Without locality, *Wright* 3463 in part.



FIG. 117.—Distribution of *P. caerulescens*.

## SPRETA.

- |                                    |                             |
|------------------------------------|-----------------------------|
| Spikelets 1.2 to 1.3 mm. long..... | 92. <i>P. leucothrix</i> .  |
| Spikelets not over 1 mm. long..... | 93. <i>P. wrightianum</i> . |

92. *Panicum leucothrix* Nash.

*Panicum leucothrix* Nash, Bull. Torrey Club 24: 41. 1897; Contr. U. S. Nat. Herb. 15: 205. 1910.

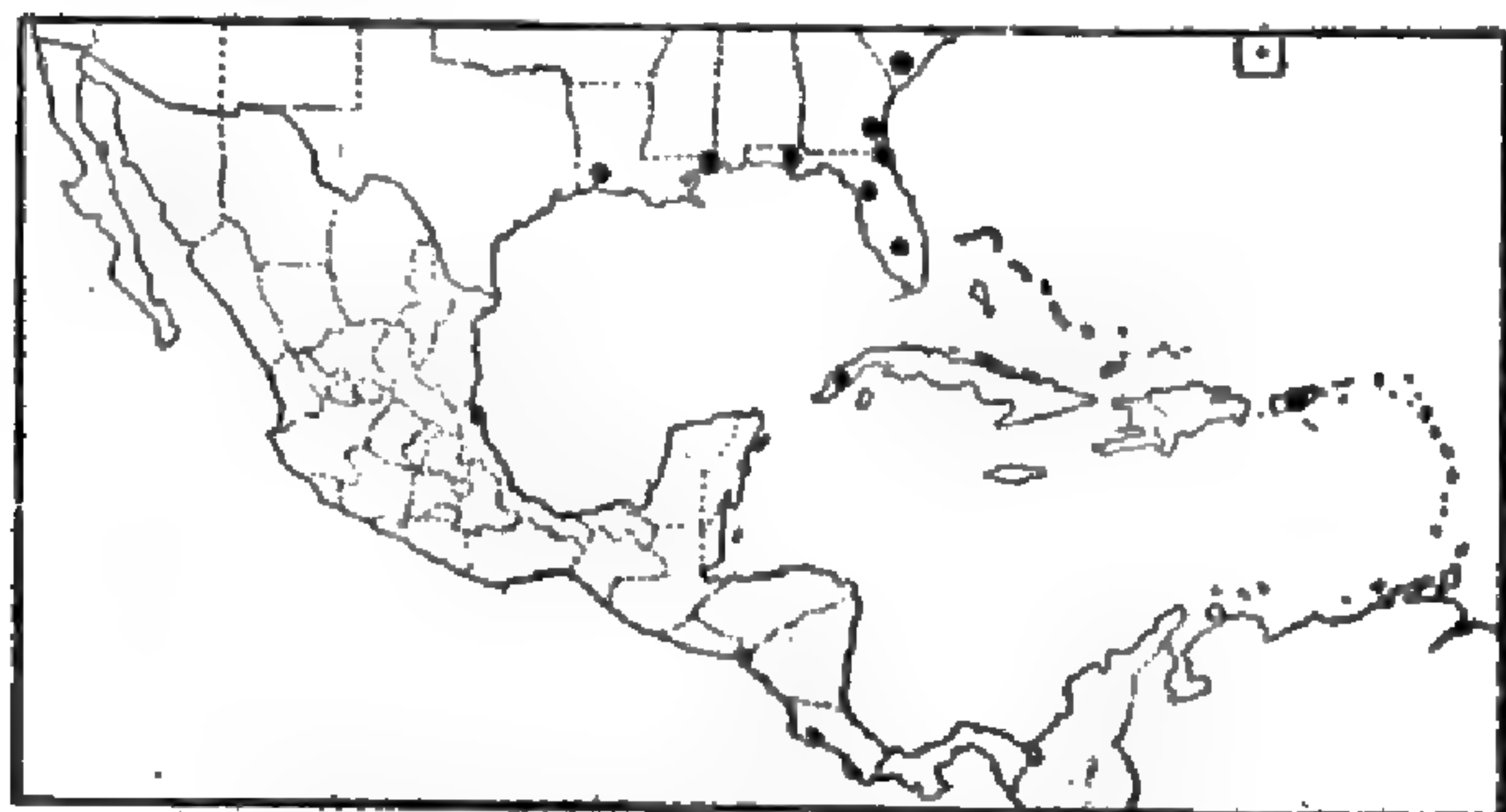


FIG. 118.—Distribution of *P. leucothrix*.

## DISTRIBUTION.

Pine woods and moist open ground, New Jersey to Louisiana, Cuba, and Porto Rico. The type specimen from Florida.

CUBA: Herradura, *Hitchcock* 554, 560. Without locality, *Wright* 3460, 3463.

PORTO RICO: Trujillo Alto, *Chase* 6770.



93. *Panicum wrightianum* Scribn.

*Panicum wrightianum* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 44. f. 4. 1898. Contr. U. S. Nat. Herb. 15: 207. 1910.

## DISTRIBUTION.

Moist sandy soil, Massachusetts to Texas and Cuba. The type specimen from Cuba.

CUBA: Pinar del Río, Britton & Gager 6952. Without locality, Wright 3463 in part.

FIG. 119.—Distribution of *P. wrightianum*.

## LANUGINOSA.

Spikelets 2.2 mm. or more long.

Pubescence on culms horizontally spreading; autumnal form freely branching..... 97. *P. villosissimum*.

Pubescence on culms appressed or ascending; autumnal form rather sparingly branching..... 98. *P. pseudopubescens*.

Spikelets not over 2 mm. long.

Plants not velvety; blades usually glabrous on the upper surface..... 94. *P. tennesseense*.

Plants velvety; blades softly pubescent on both surfaces.

Plants light or yellow green when dry..... 95. *P. acuminatum*.

Plants dark or olive green when dry..... 96. *P. olivaceum*.

94. *Panicum tennesseense* Ashe.FIG. 120.—Distribution of *P. tennesseense*.

*Panicum tennesseense* Ashe, Journ. Elisha Mitchell Soc. 15: 52. 1898; Contr. U. S. Nat. Herb. 15: 218. 1910.

## DISTRIBUTION.

Open ground, Atlantic States to Utah; also in southern Mexico. The type specimen from Tennessee.

VERACRUZ: Orizaba, Botteri 101. Jalapa, Hitchcock 6632.

95. *Panicum acuminatum* Swartz.

*Panicum acuminatum* Swartz, Prodr. Veg. Ind. Occ. 23. 1788; Contr. U. S. Nat. Herb. 15: 222. 1910.

*Panicum ornatum* Desv.; Hamilt. Prodr. Pl. Ind. Occ. 11. 1825. "Herb. Prof. Desv. Porto Rico."

In the Revision<sup>1</sup> this was listed among the doubtful species. The inadequate description indicates the common *P. acuminatum*.

<sup>1</sup> Contr. U. S. Nat. Herb. 15: 331. 1910.



## DISTRIBUTION.

Sandy pine woods, moist banks and open ground, Greater Antilles; also Colombia. The type specimen from Jamaica.

CUBA: Isle of Pines, *Palmer & Riley* 989, 1083, *Curtiss* 307, 328, *Taylor* 3873. Pinar del Río, *Palmer & Riley* 447. Herradura, *Britton, Earle & Gager* 6505, *Hitchcock* 140, *Tracy* 9078. Río Guao, *Britton & Cowell* 9673. Cuchillas de San Sebastián, *León & Shafer* 13719. Sumidero, *León* 3472, *Shafer* 13544. Without locality, *Wright* 3874.

JAMAICA: Clyde River, *Harris* 11444. Cinchona, *Harris* 11315, 11371, 11435, 11494, *Hitchcock* 9697, 9722. Hills back of Barican, *Hitchcock* 9564. Bull Head Mountain, *Hitchcock* 9538.



FIG. 121.—Distribution of *P. acuminatum*.

Gordon Town, *Hart* 736. Abbey Green, *Amer. Gr. Nat. Herb.* 133. Catherines Peak, *Harris* 11554, *Hitchcock* 9738. Below Sir Johns Peak, *Harris* 11597. Upper Clarendon, *Harris* 11109.

HAITI: Morne la Sette, *Christ* 1850.

SANTO DOMINGO: Without locality, *Eggers* 2021, 2028, 2333 (all in K. U. Herb.).

PORTO RICO: Santurce, *Heller* in 1903. Maricao, *Sintenis* 355. Bayamon, *Chase* 6378. Alto de Bandera, *Chase* 6475. Sierra de Luquillo, *Chase* 6719. Between Guainabo and Cataño, *Chase* 6647. Indiera Fria, *Chase* 6249. Trujillo Alto, *Chase* 6765. Jajome Alto, *Chase* 6752. Lares, *Sintenis* 5908. Fajardo, *Sintenis* 1224.

COLOMBIA: La Esmeralda near Jamundí, *Pittier* 932, 982a. Santa Marta, *Smith* 2140.

### 96. *Panicum olivaceum* Hitchc. & Chase.

*Panicum olivaceum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 225. 1910.

## DISTRIBUTION.

Clay slopes and open ground, Mexico to Venezuela. The type specimen from Guatemala.

VERACRUZ: Orizaba, *Bourgeau* 2383 in part, *Botteri* 99, 100, 101. Minatitlán, *Smith* 571. Jalapa, *Hitchcock* 6631, 6646, 6651, 6667, *Amer. Gr. Nat. Herb.* 134, *Pringle* 8339.

GUATEMALA: Cobán, *Türkheim* 428. Without locality, *Seler* 3235.

COSTA RICA: San Pedro de la Calabaza, *Tonduz* 10745.

PANAMA: El Boquete, *Maxon* 5136, *Hitchcock* 8189, 8252, 8280.

VENEZUELA: Tovar, *Fendler* 1638b. Pico de Naiguatá, *Pittier* 6252.

COLOMBIA: La Esmeralda, near Jamundí, *Pittier* 946.

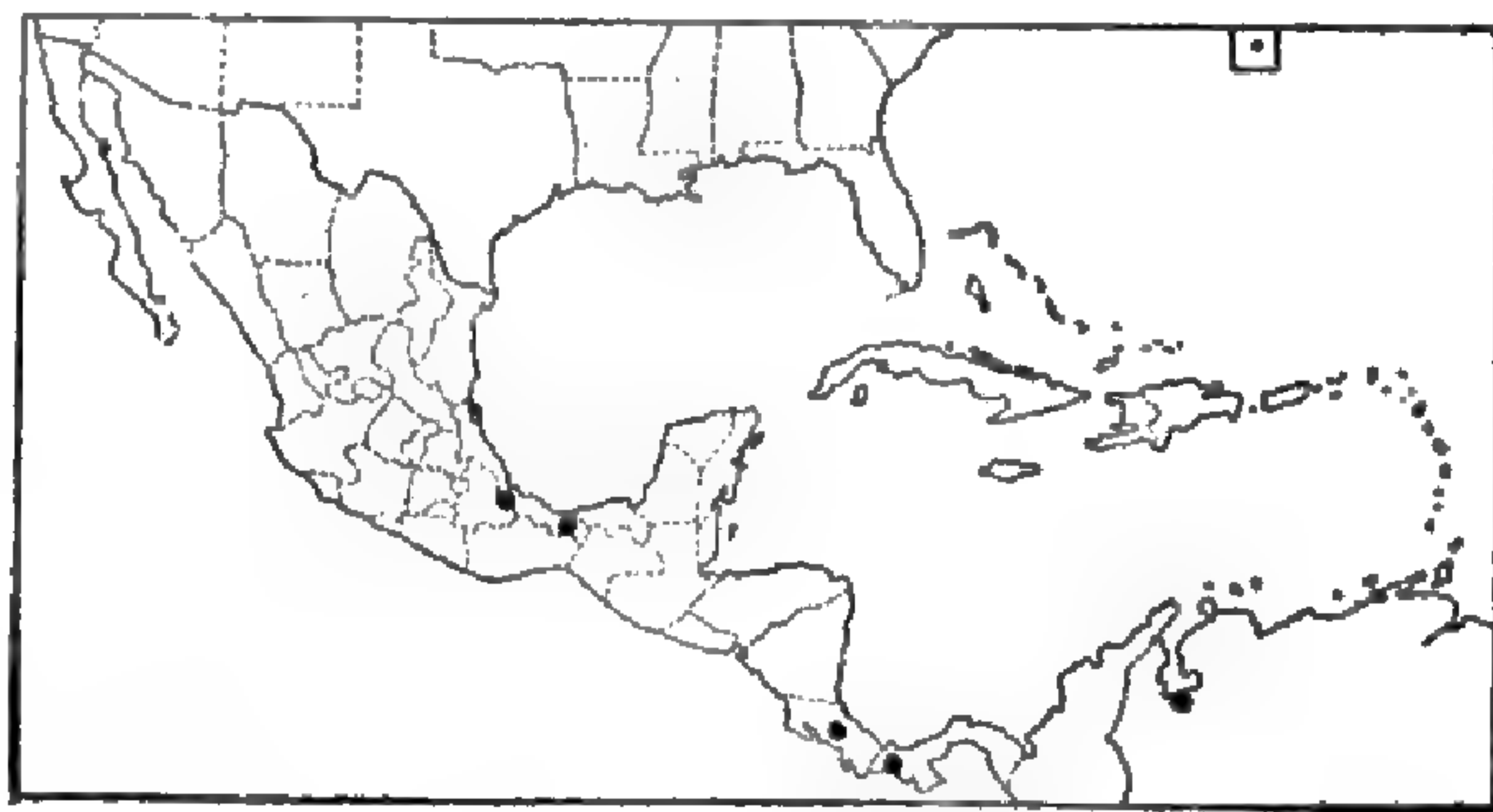


FIG. 122.—Distribution of *P. olivaceum*.



97. *Panicum villosissimum* Nash.

FIG. 123.—Distribution of *P. villosissimum*.

*Panicum villosissimum* Nash, Bull. Torrey Club **33**: 149. 1896; Contr. U. S. Nat. Herb. **15**: 233. 1910.

## DISTRIBUTION.

Dry open woods, eastern United States; also in Guatemala. The type specimen from Georgia.

GUATEMALA: Guatemala City, Hitchcock 9106.

98. *Panicum pseudopubescens* Nash.

*Panicum pseudopubescens* Nash, Bull. Torrey Club **26**: 577. 1899; Contr. U. S. Nat. Herb. **15**: 235. 1910.

## DISTRIBUTION.

Sandy open woods eastern United States; also in San Luis Potosí. The type specimen from Alabama.

SAN LUIS POTOSÍ: Without locality, Schaffner 146.


FIG. 124.—Distribution of *P. pseudopubescens*.

## SPHAEROCARPA.

Culms spreading; panicle nearly as broad as long; spikelets 1.6 to 1.8 mm. long. . . . . 99. *P. sphaerocarpon*.  
Culms erect or ascending; panicle never more than two-thirds as broad as long; spikelets 1 to 1.2 mm. long. . . . . 100. *P. erectifolium*.

99. *Panicum sphaerocarpon* Ell.

*Panicum sphaerocarpon* Ell. Bot. S. C. & Ga. **1**: 125. 1816; Contr. U. S. Nat. Herb. **15**: 251. 1910.

## DISTRIBUTION.

Sandy soil and gravelly banks, eastern United States through Mexico to northern South America. The type specimen from Georgia.

SAN LUIS POTOSÍ: Without locality, Schaffner 147.

MICHOACÁN: Sierra de San Andrés, Ross 381.

PUEBLA: Chinantla, Liebmann 327. Teziutlán, Orcutt 3952.

VERACRUZ: Orizaba, Amer. Gr. Nat. Herb. 155, Botteri. Jalapa, Pringle 7883, 8344, Hitchcock 6607, 6633.

BRITISH HONDURAS: Manatee Lagoon, Peck 61 (Gray Herb.).

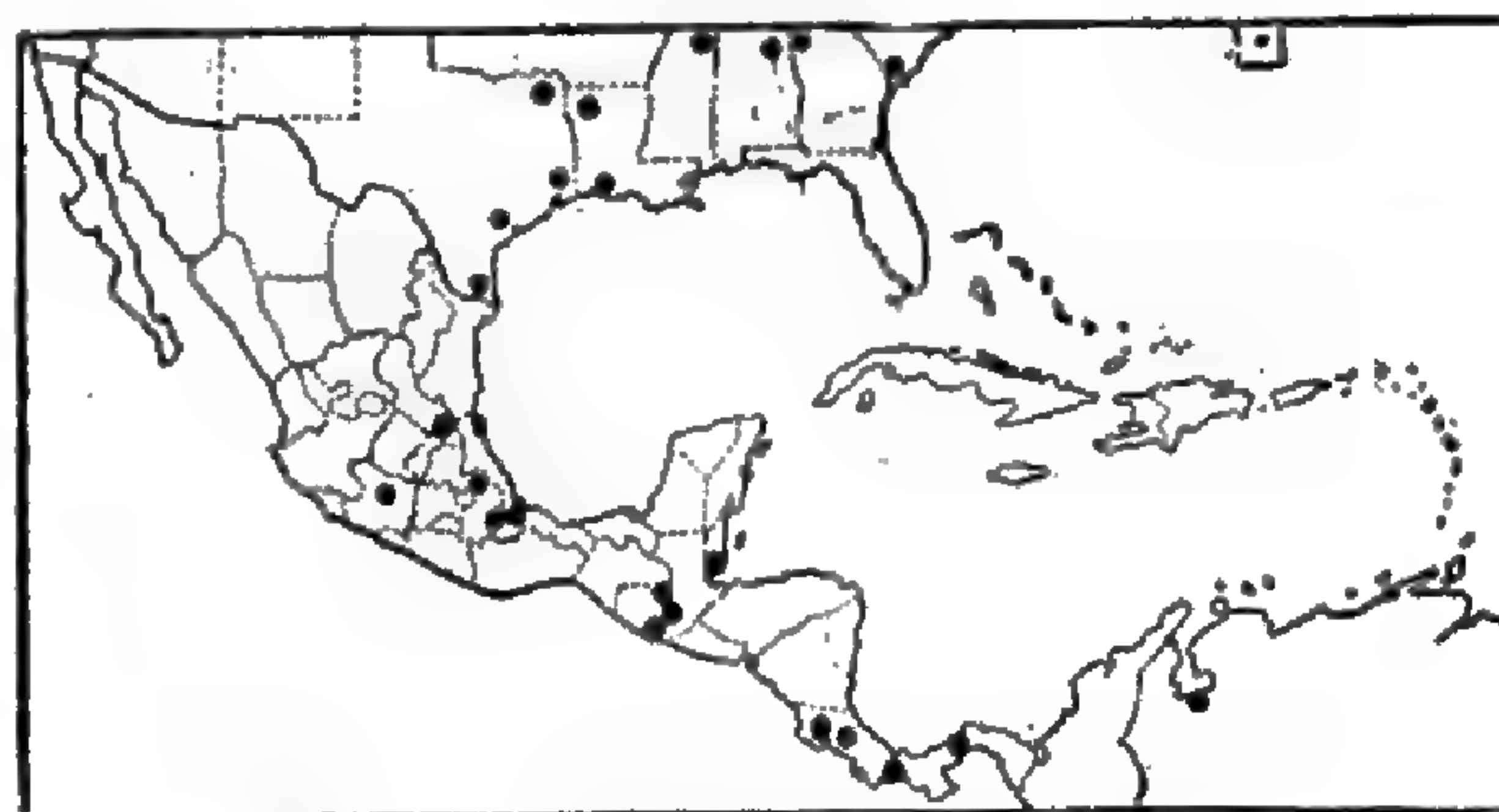
GUATEMALA: Guatemala City, Hitchcock 9105. Cobán, Türckheim 56, 3829. Volcano Pacaya, Kellerman 6236.

COSTA RICA: Copey, Tonduz 11866.

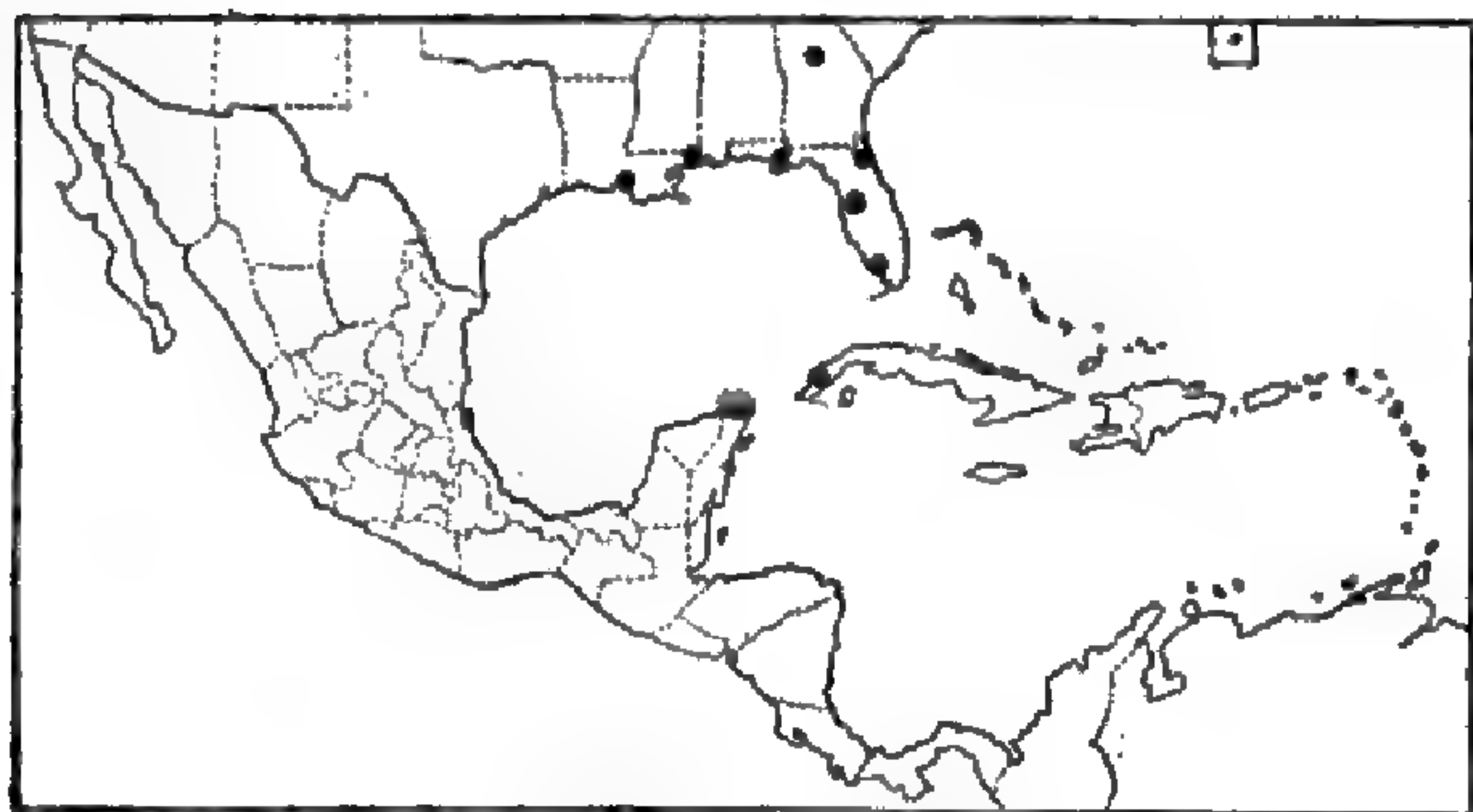
San Pedro de la Calabaza, Tonduz 10745. Páramos del Abejónal, Tonduz 7878.

PANAMA: El Boquete, Hitchcock 8172. Dolega, Hitchcock 8343.

VENEZUELA: Without locality, Fendler 1638.


FIG. 125.—Distribution of *P. sphaerocarpon*.



100. *Panicum erectifolium* Nash.FIG. 126.—Distribution of *P. erectifolium*.

*Panicum erectifolium* Nash, Bull. Torrey Club **23**: 148. 1896; Contr. U. S. Nat. Herb. **15**: 256. 1910.

## DISTRIBUTION.

Moist pine woods, southeastern United States and Cuba. Type specimen from Florida.

CUBA: Vuelta Abaja, *Wright* 3462. Laguna Santa María, *Britton & Gager* 7170.

## ENSIFOLIA.

101. *Panicum albomarginatum* Nash.

*Panicum albomarginatum* Nash, Bull. Torrey Club **24**: 40. 1897; Contr. U. S. Nat. Herb. **15**: 260. 1910.

## DISTRIBUTION.

Moist sandy woods, southeastern United States, Cuba and Guatemala. Type specimen from Florida.

GUATEMALA: Gualán to Copán, *Pittier* 1805a.

CUBA: Between Sumidero and Pinar del Río, *León* 3466. Herradura, *Hitchcock* 555. Isle of Pines, *Taylor* 32.

FIG. 127.—Distribution of *P. albomarginatum*.

## LANCEARIA.

- |                                     |                               |
|-------------------------------------|-------------------------------|
| Spikelets 1.5 to 1.6 mm. long. .... | 102. <i>P. portoricense</i> . |
| Spikelets 2 mm. long. ....          | 103. <i>P. lancearium</i> .   |

102. *Panicum portoricense* Desv.

*Panicum portoricense* Desv.; Hamilt. Prodr. Pl. Ind. Occ. 11. 1825. "Herb. Prof. Desv. Porto Rico." We have been unable to find the type of this and in the Revision <sup>1</sup> placed it among doubtful species. Recent study of the grasses of Porto Rico, however, leaves no doubt that Desvaux's description was drawn from a specimen in the autumnal phase of *P. pauciciliatum* Ashe, which is found to be common in the vicinity of San Juan Bay, the region most likely to have been visited by early botanists.

*Panicum pauciciliatum* Ashe, Journ. Elisha Mitchell Soc. **16**: 87. 1900; Contr. U. S. Nat. Herb. **15**: 272. 1910.

<sup>1</sup> Contr. U. S. Nat. Herb. **15**: 331. 1910.



DISTRIBUTION.

Moist sandy woods, southeastern United States, Cuba and Porto Rico.

CUBA: Without locality, *Wright* 3876.  
PORTO RICO: *Martin Peña*, *Chase* 6357. Between Cataño and Guainabo, *Chase* 6631. Lake Loisa, *Chase* 6783. Santurce, *Heller* 982b, 6442. Vega Baja, *Heller* 639, *Underwood & Griggs* 955. Campo Alegre, *Chase* 6434.



FIG. 128.—Distribution of *P. portoricense*.

103. *Panicum lancearium* Trin.

*Panicum lancearium* Trin. Gram. Pan. 223. 1826; Contr. U. S. Nat. Herb. 15: 273. 1910.



FIG. 129.—Distribution of *P. lancearium*.

DISTRIBUTION.

Sandy pine woods, southeastern United States, British Honduras, Cuba, and Santo Domingo. The type specimen from North America, the exact locality not known.

BRITISH HONDURAS: Sibune River, *Peck* 425 (Gray Herb.).  
CUBA: San Juan de Buenavista, *Wright* 3460 (Gray Herb.).

SANTO DOMINGO: Constanza, *Türkheim* 3321.

PEDICELLATA.

104. *Panicum nodatum* Hitchc. & Chase.

*Panicum nodatum* Hitchc. & Chase, Contr. U. S. Nat. Herb. 15: 293. 1910.

DISTRIBUTION.

Oak woods and wooded sand dunes, along the coast of Texas and adjoining Mexico. The type specimen from Texas.

MEXICO: Matamoros, *Berlandier* 988, 2418 (Gray Herb.).

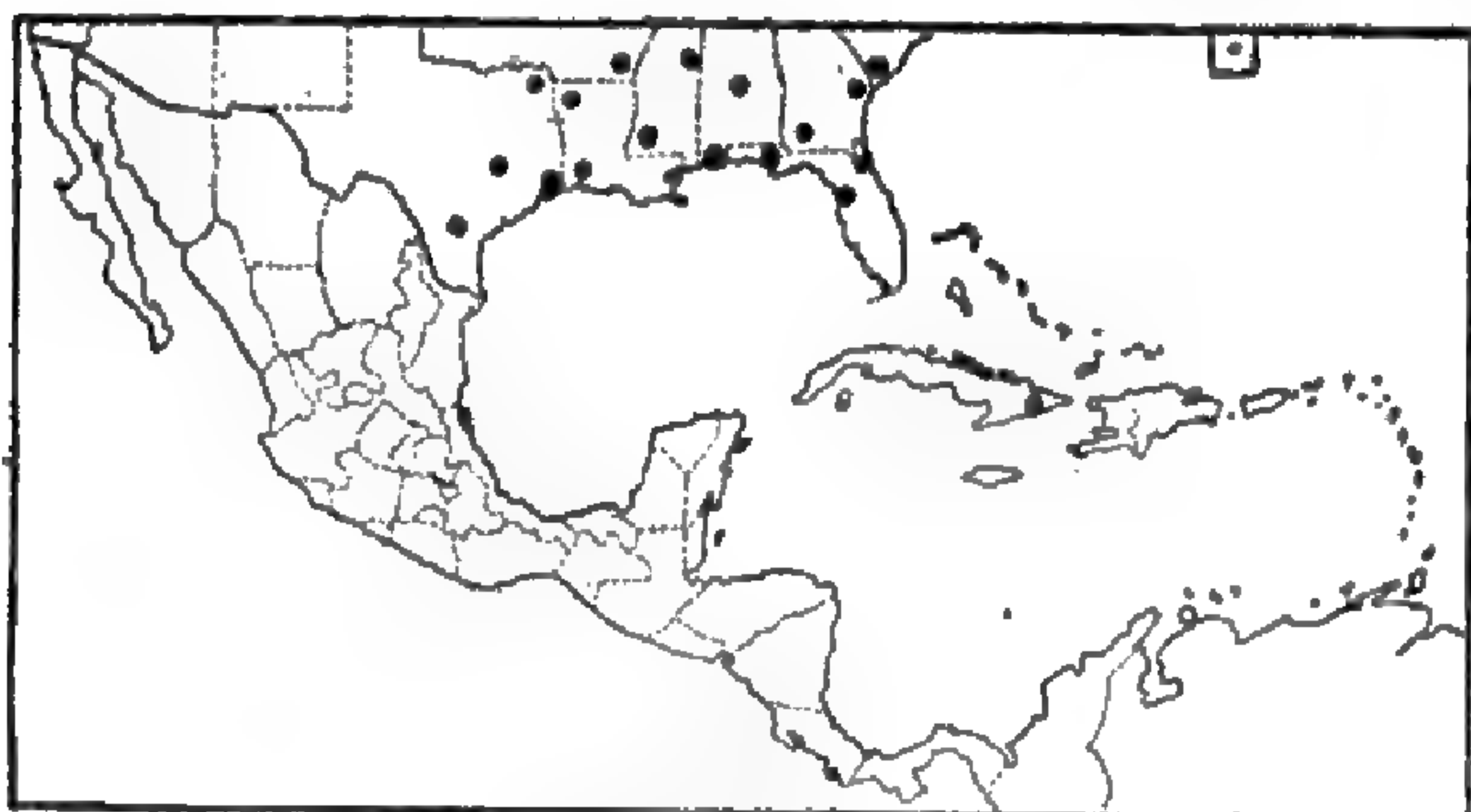


FIG. 130.—Distribution of *P. nodatum*.

SCOPARIA.

- Vernal culms erect or ascending; plants velvety throughout;  
spikelets about 2.5 mm. long..... 105. *P. scoparium*.  
Vernal culms decumbent at base; upper sheaths more or less  
glabrate; spikelets less than 2 mm. long..... 106. *P. viscidellum*.



105. *Panicum scoparium* Lam.FIG. 131.—Distribution of *P. scoparium*.

*Panicum scoparium* Lam. Encycl. 4: 744. 1798; Contr. U. S. Nat. Herb. 15: 294. 1910.

## DISTRIBUTION.

Wet places, southeastern United States and Cuba. The type specimen from South Carolina.

CUBA: Road to Pinal Mayarí, Wright 3467. Sierra Nipe, Shafer 2997, 3018.

106. *Panicum viscidellum* Scribn.

*Panicum viscidellum* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 19: 2. 1900; Contr. U. S. Nat. Herb. 15: 296. 1910.

## DISTRIBUTION.

Open woods and slopes, Mexico to Colombia; also in Cuba. The type specimen from Jalapa.

VERACRUZ: Córdoba, Hitchcock 6425. Orizaba, Amer. Gr. Nat. Herb. 179. Jalapa, Hitchcock 6606, 6673, Smith 1617, Pringle 8089. Mirador, Liebmann 323. Zacuapán, Purpus 2160.

GUATEMALA: Cobán, Türkheim 3836, 3829 in part. Sierra del Mico, Kellerman 6231, 6249.

NICARAGUA: U. S. Pacific Expl. Exped. Wright.

COSTA RICA: Asserí, Tonduz 1244. El General, Pittier 3358.

PANAMA: El Boquete, Hitchcock 8178, Pittier 3043.

CUBA: Managua, Palmer & Riley 1065.

COLOMBIA: La Esmeralda, near Jamundí, Pittier 940.

FIG. 132.—Distribution of *P. viscidellum*.

## COMMUTATA.

Blades unsymmetrical and falcate; culms decumbent; first glume about one-third as long as the spikelet ..... 107. *P. jooirii*.

Blades symmetrical, nearly linear; culms erect; first glume about half as long as the spikelet ..... 108. *P. albomaculatum*.

107. *Panicum jooirii* Vasey.FIG. 133.—Distribution of *P. jooirii*.

*Panicum jooirii* Vasey, U. S. Dept. Agr. Div. Bot. Bull. 8: 31. 1889; Contr. U. S. Nat. Herb. 15: 308. 1910.

## DISTRIBUTION.

Damp woods, southeastern United States; also in southern Mexico. The type specimen from Louisiana.

VERACRUZ: Jalapa, Hitchcock 6650.

REPUBLIC OF MEXICO: Without locality, Pringle 13290.



108. *Panicum albomaculatum* Scribn.

*Panicum albomaculatum* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 19: 2. 1900; Contr. U. S. Nat. Herb. 15: 311. 1910.

Autumnal form leaning or ascending, with geniculate nodes, branching from the lower and middle nodes, the branches nearly as long as the primary culm, erect, simple or sparingly branching, the sheaths overlapping, the blades scarcely reduced, the panicles short-exserted; apparently no winter rosette developed.

One specimen, *Hitchcock* 6979, has harshly pilose foliage, but in all other respects its characters are those of *P. albomaculatum*.

DISTRIBUTION.

Shady banks and wooded slopes, Mexico and Guatemala. The type specimen from Pátzcuaro.

JALISCO: Zapotlán, *Hitchcock* 7170, *Amer. Gr. Nat. Herb.* 193.

MICHOACÁN: Pátzcuaro, *Pringle* 5203. Uruápan, *Hitchcock* 6979. Jorullo, *Humboldt* (Willd. Herb.).

GUATEMALA: Antigua, *Hitchcock* 9139.



FIG. 134.—Distribution of *P. albomaculatum*.

CORDOVENSIA.

Plants perennial, straggling, the culms decumbent at base, rooting at the nodes; ligules membranaceous, minute; spikelets elliptical, the first glume two-thirds the length of the spikelet or more; fruit smooth and shining, apiculate.

This group, to which are apparently allied the South American *Panicum phragmites* Nees (*P. discolor* Trin., not Spreng.) and *P. ovuliferum* Trin., appears to be intermediate between true *Panicum* and the subgenus *Dichanthelium*, having the sterile primary panicles and secondary panicles with fruitful, probably cleistogamous, spikelets, but not forming a winter rosette.

- Plants glabrous or the leaves sparsely pilose . . . . . 109. *P. cordovense*.
- Plants velvety pubescent . . . . . 110. *P. chiriquiense*.

109. *Panicum cordovense* Fourn.

*Panicum cordovense* Fourn. Mex. Pl. 2: 26. 1886. “Cordova (Schaffn. n. 293 in herb. FRANQ.).” The type specimen in the herbarium of Drake de Castillo, now a part of the herbarium of the Jardin des Plantes, Paris, has glabrous spikelets (like that shown in Fig. 135). This in the Revision was listed among the doubtful species.<sup>1</sup>

*Panicum expansum* Fourn. Mex. Pl. 2: 26. 1886 (following *P. cordovense*). “Huitamalco (Liebm. n. 426).” The type specimen, in the Copenhagen Herbarium, has a large immature primary panicle, the spikelets glabrous. In the Revision<sup>2</sup> it was suggested that this unknown species was related to *P. costaricense*.

*Ichnanthus apiculatus* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 1. 1901. “Type specimen from near Jalapa, State of Vera Cruz. C. G. Pringle, no. 9208.” In the type specimen, in the United States National Herbarium, the spikelets are glabrous.

*Panicum missionum* Ekman, Ark. för Bot. 11<sup>4</sup>: 19. pl. 3. f. 1. 1912. “Bonpland, ad rivulum prope praedium ‘Almacén finlandesa,’ 26. 12. 07. N. 632.”, collected by E. L. Ekman, in the State of Misiones, Argentina. An immature specimen of the type collection is in the U. S. National Herbarium, received from Dr. Ekman. The

<sup>1</sup> Contr. U. S. Nat. Herb. 15: 329. 1910.  
<sup>2</sup> Contr. U. S. Nat. Herb. 15: 134. 1910.



photograph of the type specimen (plate 3, figure 1) shows the large open primary panicle, like that of the type of *P. expansum*, which is characteristic of the early phase of the species.

## DESCRIPTION.

Plants perennial in tangled masses; culms slender, subcompressed, a line of pubescence down one side or glabrous, rarely sparsely pilose, straggling, widely creeping, rooting at the lower nodes, as much as 2 meters long, freely branching, the branches

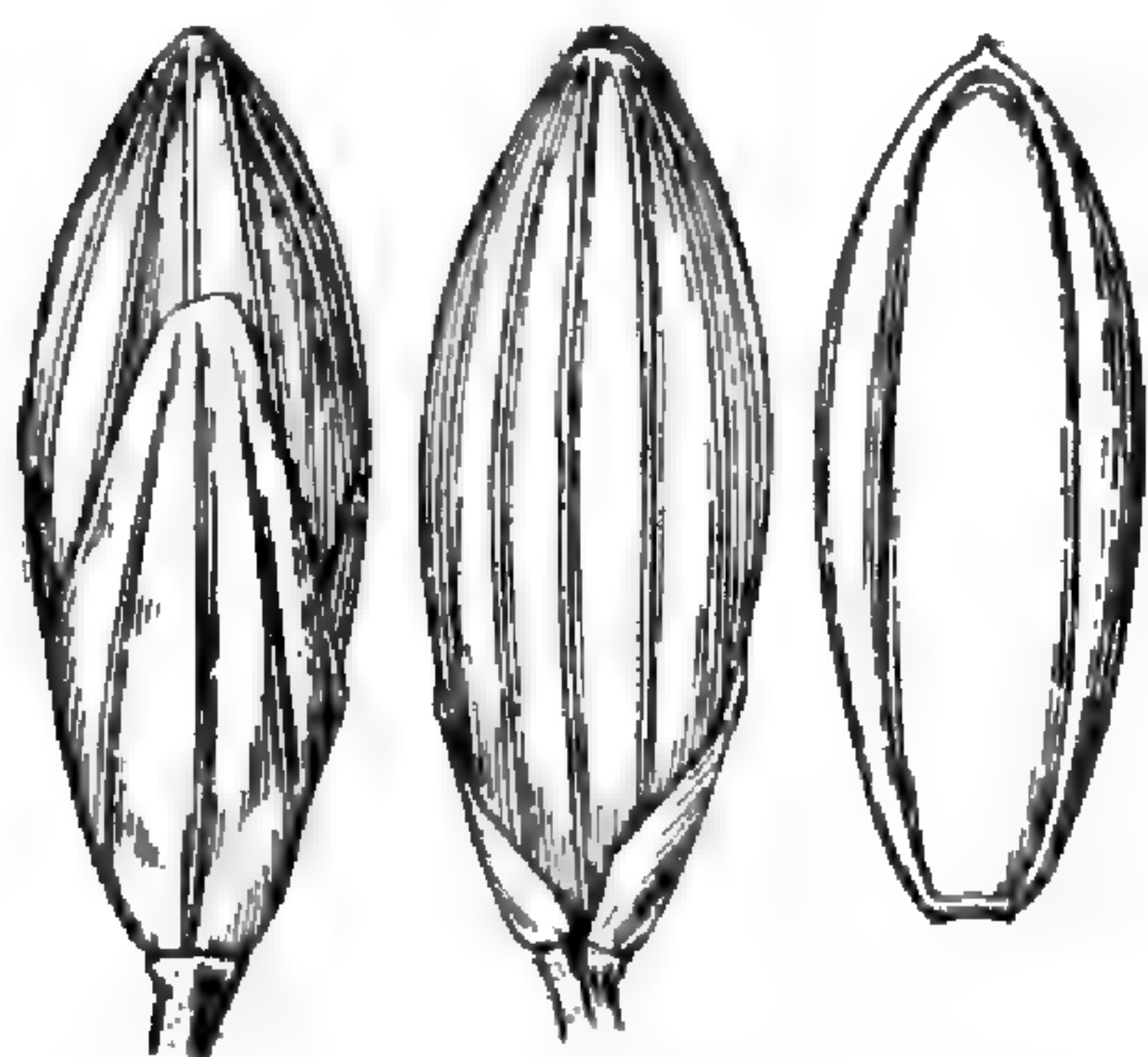


FIG. 135.—*P. cordovense*. From Hitchcock 8328.

usually divergent, becoming nearly as long as the primary culm; nodes puberulent or glabrate; sheaths much shorter than the usually elongate internodes, sparsely papillose-pilose or papillose only, densely ciliate on the margin, puberulent at the junction with the blade; ligule about 0.3 mm. long; blades thin, flat, spreading, 5 to 10 cm. (rarely as much as 15 cm.) long, 5 to 10 mm. wide, narrowly lanceolate, acuminate, rounded and usually ciliate at base, scaberulous on both surfaces at least on the midnerve, usually papillose-hispid above the ligule, sometimes sparsely so throughout; panicles of two kinds, the primary short-exserted or included at base, loose and

open, 10 to 15 cm. long, half to two-thirds as wide, the axis and branches slender, subflexuous, scaberulous, pubescent in the axils, the few branches solitary or in pairs, remote, simple or nearly so, finally spreading, few-flowered, the branchlets and short-pediceled, apparently unfruitful spikelets more or less appressed to the rachis, the secondary panicles terminal on the branches, reduced, narrow, few-flowered, partially inclosed in the sheath, the crowded apparently cleistogamous spikelets fruitful; spikelets 3 to 3.5 mm. long, 1.2 to 1.4 mm. wide, those of the primary panicles usually glabrous, those of the secondary panicles usually pustulose-villous, turgid; first glume about two-thirds as long as the spikelet, obtuse, 3 to 5-nerved, the second glume and sterile lemma equal, covering the fruit, 7-nerved, the middle internerves of the sterile lemma in the pubescent spikelets usually glabrous, the midnerve sometimes indistinct; fruit 2.8 to 2.9 mm. long, 1.1 to 1.2 mm. wide, apiculate.

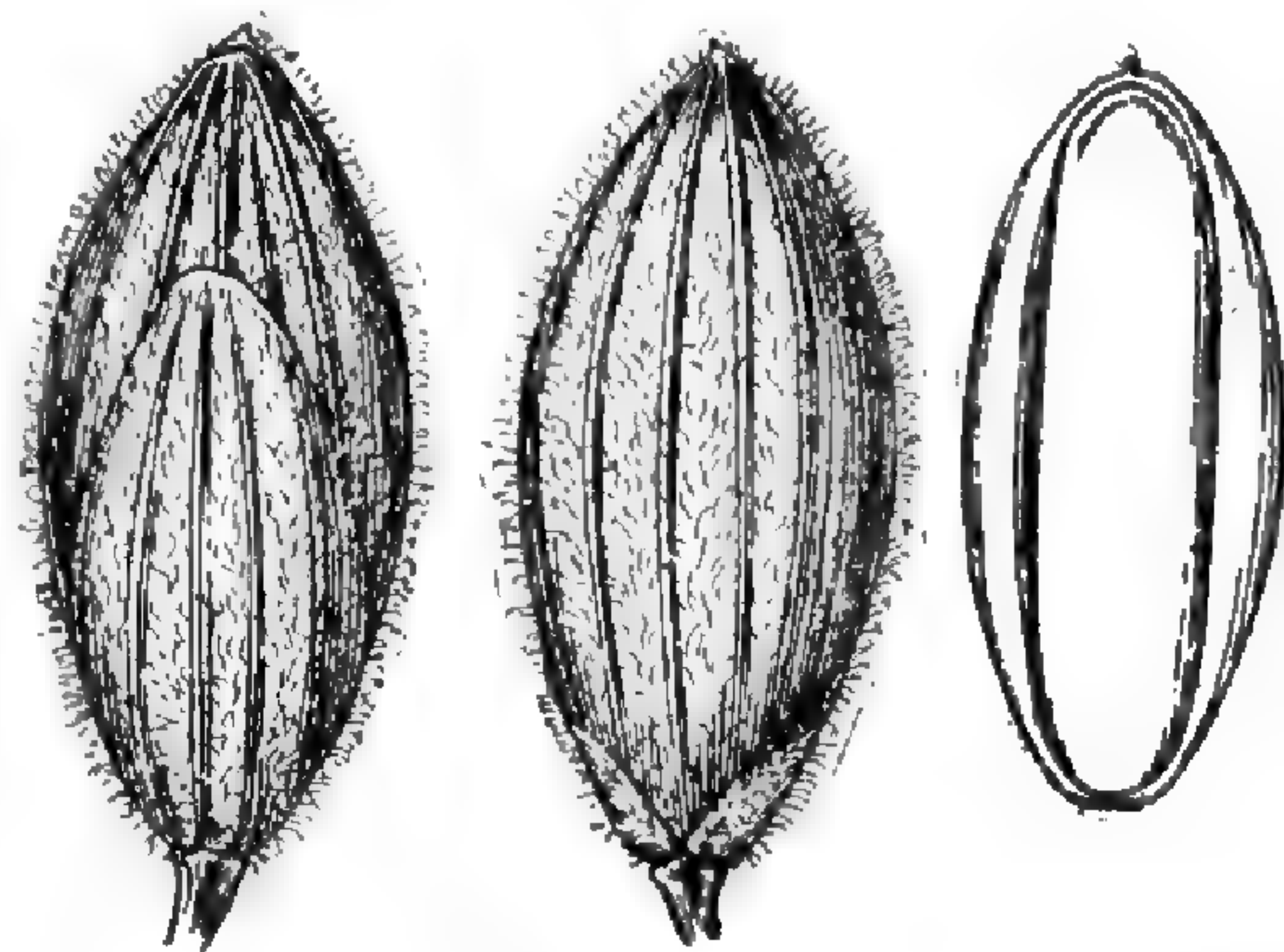


FIG. 136.—*P. cordovense*. From Hitchcock 8328.

The spikelets shown in figures 135 and 136 are from the terminal and lateral panicles respectively of the same individual.

## DISTRIBUTION.

Shady banks and in deep woods, southern Mexico to Argentina.



FIG. 137.—Distribution of *P. cordovense*.

VERACRUZ: Córdoba, *Schaffner* 293.  
Jalapa, *Pringle* 9208, *Hitchcock* 6611. Huitmalco, *Liebmann* 426.

COSTA RICA: Piedra del Convento, *Pittier* 3655.

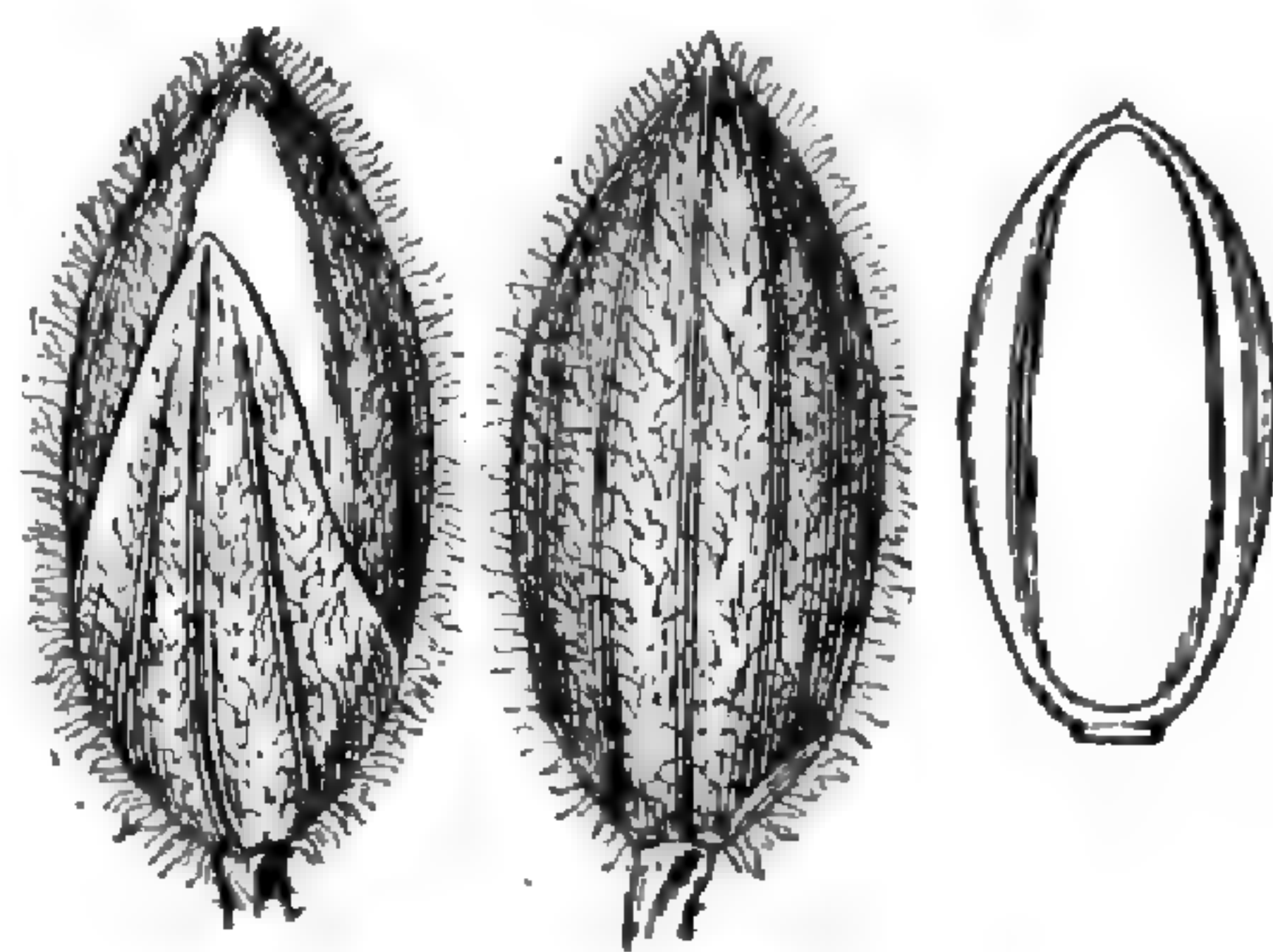
PANAMA: Chiriquí Volcano, *Hitchcock* 8196. El Boquete, *Hitchcock* 8271, 8275, 8303, 8328.



110. *Panicum chiriquiense* sp. nov.

## DESCRIPTION.

Plants perennial, olivaceous; culms straggling, creeping and rooting at the lower nodes, softly papillose-pilose, freely branching, the leafy fertile branches ascending, 20 to 30 cm. high; nodes pilose; sheaths nearly as long as the internodes or the upper overlapping, softly papillose-pilose; ligule about 0.5 mm. long; blades flat, somewhat spreading, 4 to 7 cm. long, 7 to 10 mm. wide, narrowly lanceolate, unsymmetrical at base and often somewhat falcate, acuminate, softly papillose-villous beneath, rather sparsely pilose on the upper surface; panicles short-exserted or included at base, 2.5 to 3.5 cm. long, half to two-thirds as wide, the few branches ascending, the axis and few nearly simple branches slender, villous; spikelets short-pedicelled, 2.6 to 2.8 mm. long, about 1.1 mm. wide, elliptical; first glume about three-fourths as long as the spikelet, acute, 3-nerved, villous; second glume and sterile lemma equal, covering the fruit, the glume villous, minutely apiculate, the lemma usually subindurate, smooth and shining in the two middle internerves, the midnerve suppressed or evident at the summit only, the lateral internerves villous; fruit 2.1 mm. long, 1 mm. wide, minutely apiculate.

FIG. 138.—*P. chiriquiense*. From type specimen.

Type in the U. S. National Herbarium, no. 725186, collected "in shade along trail, hillside jungle, foothills, vicinity of El Boquete, province of Chiriquí, Panama, altitude 1,000 to 1,300 meters, October 4, 1911," by A. S. Hitchcock (no. 8313).

FIG. 139.—Distribution of *P. chiriquiense*.

Known only from the type collection. This species differs from *P. cordovense* in the villous foliage with shorter, unsymmetrical blades, the less elongate culms, and the smaller spikelets. In the specimens collected all the panicles are terminal on the branches. Whether or not the plants at an earlier season bear large panicles

on a primary culm is not known. The character of the suppressed midnerve and smooth middle internerves, rare in *P. cordovense*, is usual and emphasised in *P. chiriquiense*. Only an occasional spikelet in panicles with the usual form has undifferentiated middle internerves.

## MISCELLANEOUS SPECIES.

111. *Panicum obtusum* H. B. K.

*Panicum obtusum* H. B. K. Nov. Gen. & Sp. 1: 98. 1816; Contr. U. S. Nat. Herb. 15: 321. 1910.

## DISTRIBUTION.

Moist sandy or gravelly soil, southwestern United States to central Mexico. The type specimen from Guanajuato.

SONORA: Nogales to Cocospora Ranch, *Griffiths* 6800.

CHIHUAHUA: Between Casas Grandes and Sabinal, *Nelson* 6352. Chihuahua, *Pringle* 476. Miñaca, *Hitchcock* 7734.



DURANGO: Durango, *Palmer* 175 in 1896, *Hitchcock* 7618. Torreón, *Hitchcock* 7563.  
 COAHUILA: Saltillo, *Palmer* 394 and 504 in 1898, *Hitchcock* 5582. La Ventura, *Nelson* 3908. Jaral, *Schumann* 1714.  
 NUEVO LEÓN: Monterrey, *Hitchcock* 5533.

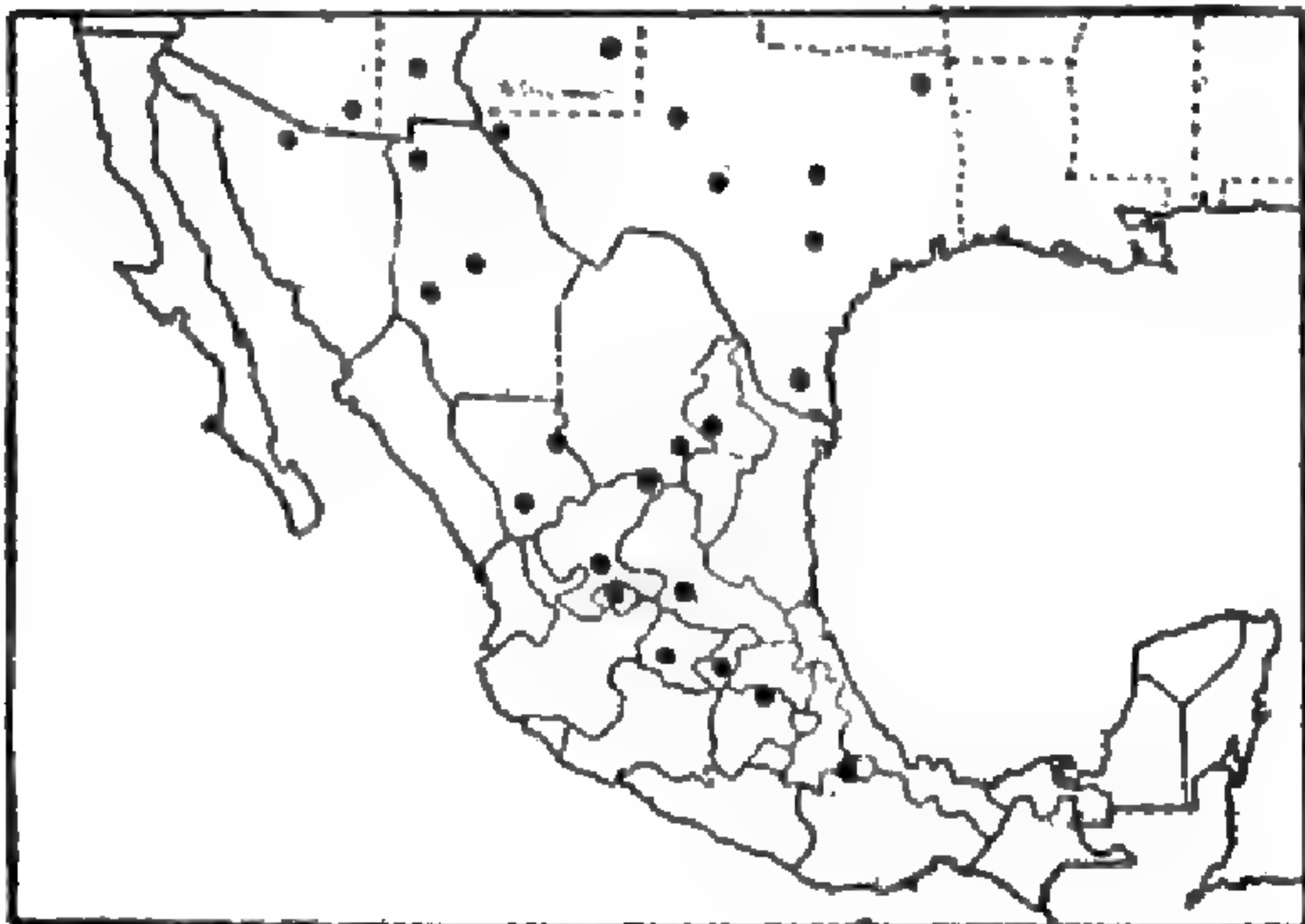


FIG. 140.—Distribution of *P. obtusum*.

HIDALGO: Tula, *Rose, Painter & Rose* 8356. Ixmiquilpan, *Rose, Painter & Rose* 9057.  
 PUEBLA: Tehuacán, *Hitchcock* 6060.  
 REPUBLIC OF MEXICO: Without locality, *Hartweg* 244.

ZACATECAS: Concepción del Oro, *Palmer* 266 in 1904. Zacatecas, *Hitchcock* 7525.

AGUASCALIENTES: Aguascalientes, *Rose & Hay* 6231, *Hitchcock* 7456.

SAN LUIS POTOSÍ: San Luis Potosí, *Palmer* 590 in 1898, *Parry & Palmer* 960 in 1878, *Schaffner* 148, *Hitchcock* 5657.

GUANAJUATO: Obregón, *Hitchcock* 5801. Irapuato, *Hitchcock* 7407.

QUERÉTARO: San Juan del Río, *Rose, Painter & Rose* 9552, 9594. Querétaro, *Hitchcock* 5813, 5863.

## 112. *Panicum stagnatile* sp. nov.

### DESCRIPTION.

Plants perennial, gregarious; culms erect from an ascending or decumbent base rooting at the nodes, somewhat lush, 1 to 2 meters high, about 5 mm. thick, glabrous, simple or occasionally with sterile branches; nodes glabrous or the lower retrorsely appressed-pubescent; sheaths usually about as long as the internodes or the upper overlapping, ciliate on the margin, otherwise glabrous or pubescent on the sides at the junction with the blade; ligule membranaceous, less than 1 mm. long; blades flat, 20 to 35 cm. long, 1.5 to 3 cm. wide, slightly narrowed to the rounded base, tapering from below the middle to an acuminate apex, sparingly pilose above the ligule, otherwise glabrous, the margins scabrous; panicle 20 to 40 cm. long, about half as wide, fusiform in outline, the main axis and rachises strongly angled, scabrous, usually sparsely pilose in the lower axils, the numerous slender, compound branches rather stiffly ascending or spreading, solitary or irregularly fascicled, bearing from near the base and usually along the lower side rather stiffly spreading slender secondary branchlets, the lower 1 to 2 cm. long; spikelets loosely clustered, short-pedicelled, glabrous, 1.8 mm. long, about 0.6 mm. wide, acute; first glume about one-third as long as the spikelet, acute, scabrous on the keeled midnerve, the second glume two-thirds as long as the spikelet, somewhat boat-shaped, scabrous on the keel, the sterile lemma slightly exceeding the fruit, boat-shaped and scabrous on the midnerve at the apex; fruit 1.6 mm. long, 0.4 mm. wide, lanceolate, scabrous at the acute apex, the lemma and palea subindurate, the margins of the lemma inrolled only at the base.



FIG. 141.—*P. stagnatile*.  
From type specimen.

Type in the U. S. National Herbarium, no. 693328, collected in water of swamp, Frijoles, Canal Zone, Panama, October 12, 1911, by A. S. Hitchcock (no. 8388).

This species is allied to *P. rivulare* Trin. but differs in the broader blades, less densely flowered panicle branches, and smaller spikelets. The numerous small spikelets and slender branchlets give the panicle a lacelike appearance. The type locality is now covered by the water of Gatun Lake.



## DISTRIBUTION.

Swamps, growing in the water, southern Mexico to Panama.

TABASCO: Between San Juan Bautista and San Sebastián, *Rovirosa* 625.

GUATEMALA: Puerto Barrios, *Hitchcock* 9153.

PANAMA: Frijoles, *Hitchcock* 8388.



FIG. 142.—Distribution of *P. stagnatile*.

113. *Panicum grande* sp. nov.

Plants perennial, gregarious, producing extensively creeping or floating leafy stolons about 5 mm. thick; culms 1.5 to 2 meters or more high, erect from a long decumbent base with papery sheaths and tufts of fibrous roots, 1 to 2 cm. thick, simple or sparingly branching, succulent, the nodes densely appressed-hirsute; sheaths overlapping except toward the summit, glabrous, the junction with the blade in drying presenting a darkened triangle on each side; ligule membranaceous, about 2 mm. long; blades flat, as much as 1 meter long and 6 cm. wide (the upper and lower smaller), at base narrower than the sheath, gradually widening to about the middle, narrowing rather abruptly to the acuminate apex, glabrous, striate, somewhat plicate, the margins strongly serrulate; panicle as much as 60 cm. long and 40 cm. wide, the axis

and branches strongly several-angled, scaberulous, the prominent pulvilli minutely pubescent, the branches stiffly spreading, naked at base, the lower in whorls, the short ultimate branchlets and the pedicels appressed along the rather loose secondary branchlets, the pedicels mostly 1 to 2 mm. long; spikelets 2.5 mm. long, 0.9 mm. wide, nearly terete, pointed, glabrous; first glume slightly over half the length of the spikelet, the second glume and sterile lemma equal, exceeding the fruit, somewhat beaked beyond it; fruit 1.8 mm. long, 0.7 mm. wide, narrowly obovate, smooth and shining, the lemma and palea indurate but the lemma margins flat.

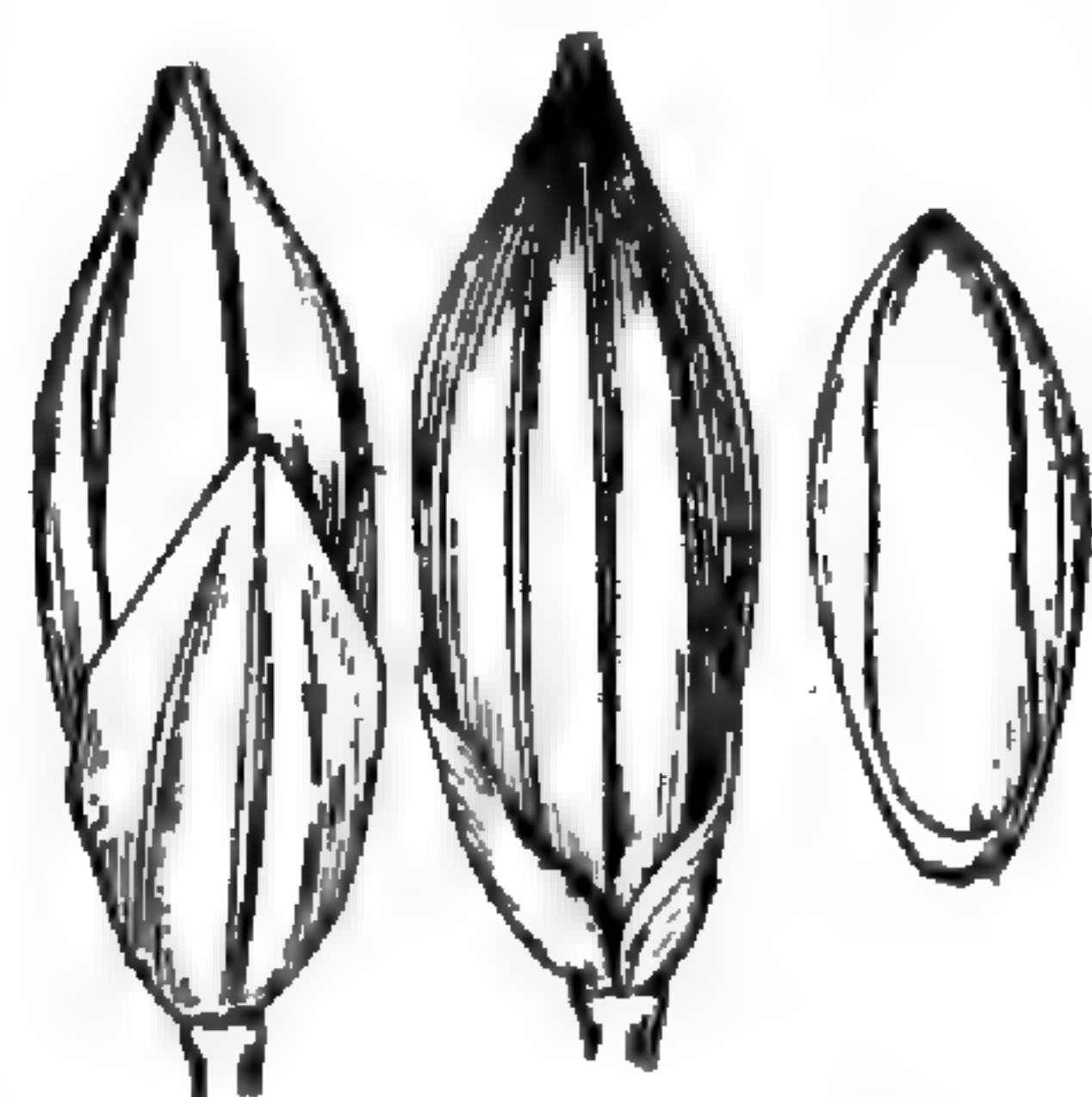


FIG. 143.—*P. grande*. From type specimen.

Type in U. S. National Herbarium, nos. 693329, 693330, 693331 (parts of the same individual), collected in the water of a swamp along the margin of Gatun Lake, Canal Zone, Panama, December 15, 1911, by A. S. Hitchcock (no. 9178).

This species grows in large masses in swamps, flowering in December. The broad blades give a lily-like aspect to the plants earlier in the season. In Gatun Lake, Panama, plants were found growing in 10 feet of water.

Doell<sup>1</sup> describes this species under the name *Panicum multiflorum* Poir.,<sup>2</sup> but the latter name applies to a different species.<sup>3</sup> *Panicum grande* is allied to the South American *P. grumosum* Nees, *P. rivulare* Trin., and *P. prionitis* Nees, from all of which it differs in its aquatic habit and open panicle and in the more indurate fertile lemma and palea; from *P. rivulare* and *P. prionitis* in the equal second glume and fertile lemma.

<sup>1</sup> Mart. Fl. Bras. 2<sup>2</sup>: 215. 1877.

<sup>2</sup> Encycl. 4: 282. 1816.

<sup>3</sup> See Contr. U. S. Nat. Herb. 15: 48. 1910.



FIG. 144.—Distribution of *P. grande*.

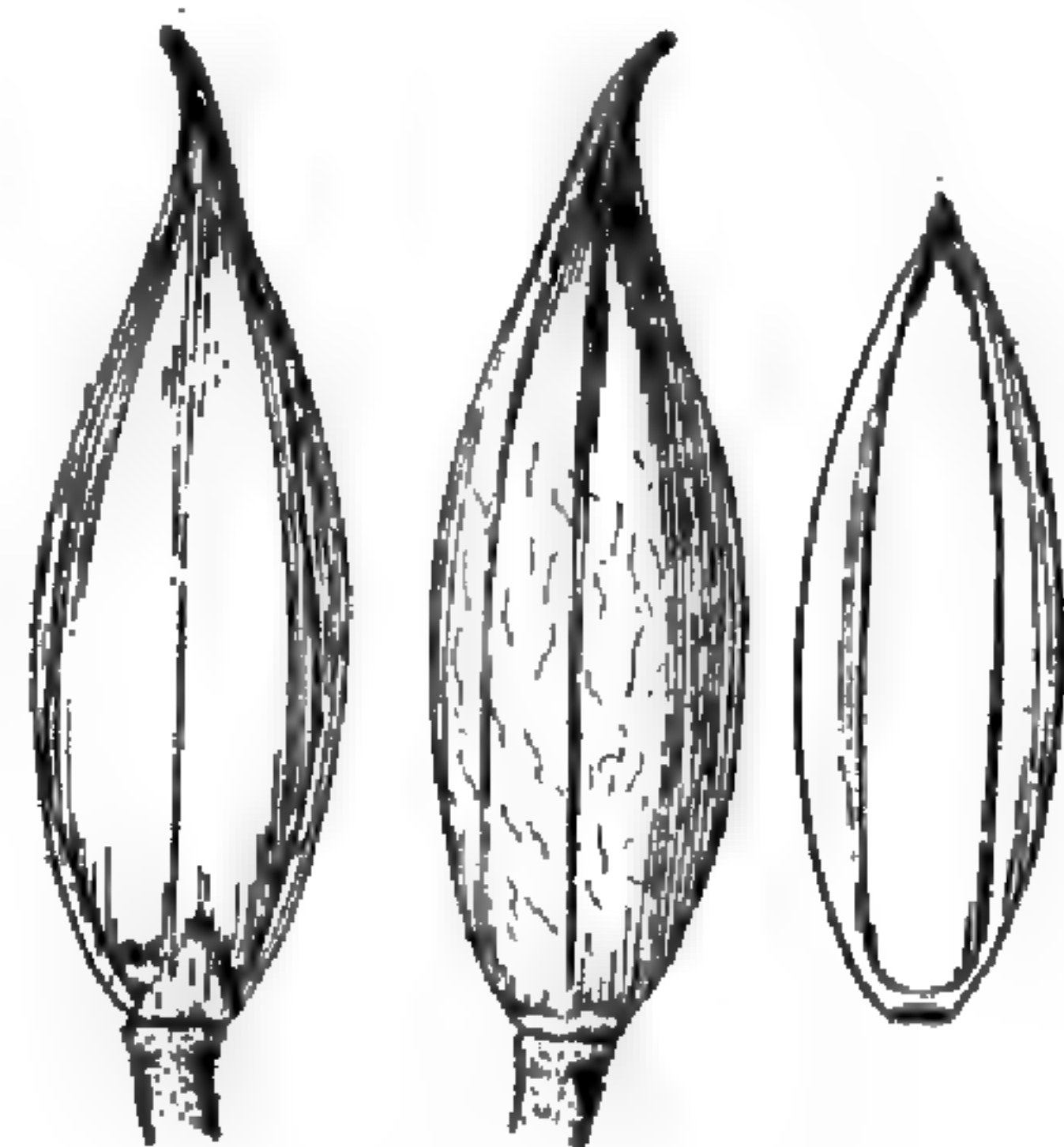
VENEZUELA: Bobures, *Jahn* 353.

#### 114. *Panicum tuerckheimii* Hack.

*Panicum tuerckheimii* Hack. Oesterr. Bot. Zeitschr. 12: 60. 1906. Guatemala, Cubilgüitz [Cubilquitz] im Hochwald, 350 m s m. leg H. v. Tuerckheim (1903 sub nr. II. 820)."

##### DESCRIPTION.

Plants perennial from a firm knotty base with strong roots; culms erect or ascending, simple, 30 to 50 cm. high, compressed, glabrous, the nodes appressed-hirsute, few to several long erect leaves borne at the base; sheaths compressed-keeled, more or less hispidulous at the junction with the blade, otherwise glabrous, those of the basal leaves loose, overlapping, those of the culm about as long as the internodes; ligule membranaceous-ciliate, scarcely 0.5 mm. long; blades thin, flat, 10 to 25 cm. long, 2 to 2.5 cm. wide, gradually tapering from about the middle to an acuminate apex, the uppermost rather abruptly narrowed to a somewhat rounded ciliate base, the lower and especially the basal blades gradually tapering into a narrow, more or less folded, petiole-like base, ciliate on the margins, puberulent on the upper surface at the very base; panicle short exserted, 15 to 20 cm. long, less than one-fourth as wide, the slender angled axis and branches glabrous, the branches remote, rather stiffly ascending, with short ascending remote branchlets, these spikelet-bearing from the base, more or less pilose in the axils, the lower branches about 10 cm. long; spikelets rather short-pedicelled, russet brown, 2.5 to 3 mm. long, about 0.9 mm. wide, acuminate, very sparsely appressed-pilose; first glume minute, hyaline; second glume and sterile lemma rather faintly nerved, subequal, or the acuminate tip of the glume exceeding the lemma; the sterile palea wanting; fruit 2.4 mm. long, 0.8 mm. wide,

FIG. 145.—*P. tuerckheimii*.  
From type specimen.FIG. 146.—Distribution of *P. tuerckheimii*.

but is so thin in texture and so closely appressed that the nerves and the base of the sterile lemma are obscurely visible through it.

This species, known only from the type collection, has no close allies.

##### DISTRIBUTION.

Lakes, ponds, and swamps, growing in the water, Panama to Pará.

PANAMA: Gatun, *Hitchcock* 9178. Along the Sambú River, *Pittier* 5546.

TRINIDAD: Mazanilla, *Hitchcock* 10376. Cedros, *Hitchcock* 10148. St. Joseph, *Hitchcock* 10022.

<sup>1</sup>Contr. U. S. Nat. Herb. 15: 16. 1910.



115. *Panicum zizanioides* H. B. K.

*Panicum zizanioides* H. B. K. Nov. Gen. & Sp. 1: 100. 1816; Contr. U. S. Nat. Herb. 15: 325. 1910.

## DISTRIBUTION.

Moist usually shaded places, Mexico and the West Indies to Paraguay. The type locality, Colombia.

VERACRUZ: Córdoba, *Hitchcock* 6436.

OAXACA: Trapeche de la Concepción, *Liebmann* 394.

TABASCO: San Juan Bautista, *Rovirosa* 624.

CHIAPAS: Ocuilapa, *Nelson* 3023.

GUATEMALA: Cubilquitz, *Türkheim* 7699, 7700, 8785, 8796. Cobán, *Türkheim* 3828.

NICARAGUA: Jinotepe, *Hitchcock* 8680.

COSTA RICA: Hacienda de Zent, *Tonduz* 302. La Florida, *Pittier* 11276. Matina, *Pittier* 10307. Talamanca, *Tonduz* 8566. San Rafael, *Pittier* 2598.

PANAMA: David, *Hitchcock* 8351. Tabernilla, *Hitchcock* 8112, 8385. Gatun, *Hitchcock* 7974. Gamboa, *Pittier* 4790. Between Gamboa and Cruces, *Pittier* 3781. Along the Río Sirrí, *Pittier* 4026.

CUBA: Sancti Spiritus, *León* 903. Laguna Castellano, *Baker* 4334, *Wilson* 9567. Puentes Grandes, *León* 2743. Sumidero, *León* 13635. Without locality, *Wright* 3466.

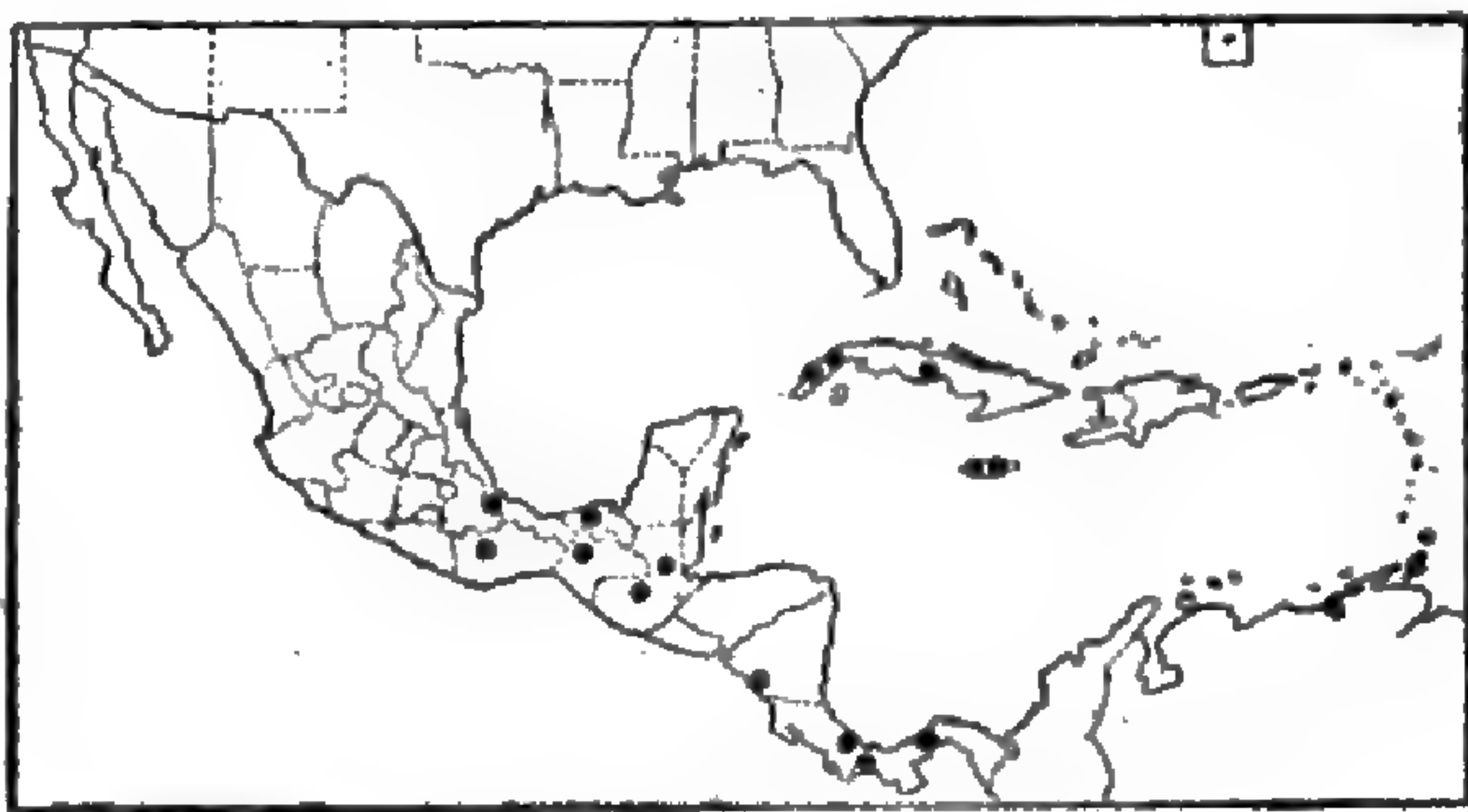


FIG. 147.—Distribution of *P. zizanioides*.

JAMAICA: Gordon Town, *Hart* 726. Port Antonio, *Maxon* 2109. Ramble, *Hitchcock* 9513. Castleton Gardens, *Hitchcock* 9398. Above Constant Spring, *Hitchcock* 9278. Buff Bay, *Hitchcock* 9779. Ipswich, *Hitchcock* 9609. Ewarton to Linstead, *Hitchcock* 9419. St. Georges, Portland, *Harris* 11420. Temple Hall, *Harris* 11385. Troy, *Hitchcock* 9781. Montego Bay, *Hitchcock* 9684. Without locality, *Alexander Prior* in 1850, *Wulfschlaegel* 1108.

TRINIDAD: Port of Spain, *Hitchcock* 9958. Mount Pleasant Estate, *Bot. Gard. Herb.* 2286. Toco, *Broadway* 2563. Without locality, *Bot. Gard. Herb.* 3188.

TOBAGO: Great Dog River, *Eggers* 5810. Roxburgh, *Hitchcock* 10258. Easterfield, *Broadway* 4556.

116. *Panicum hirtum* Lam.

*Panicum hirtum* Lam. Encycl. 4: 741. 1798. Lamarck states that "Cette plante croît à Cayenne, d'où elle a été envoyée par Jos. Martin." The type specimen in the Lamarck Herbarium is marked "*Panicum hirtum* Lam. dict. Cayenne. Martin."

## DESCRIPTION.

Plants annual, at first simple and erect, later branching and decumbent, rooting at the lower nodes; culms slender, puberulent, the fertile branches 20 to 40 cm. high; sheaths shorter than the internodes, loose, short-villous, densely ciliate on the margin; ligule a delicate toothed membrane less than 0.5 mm. long; blades flat, thin, 2 to 6 cm. long, 0.8 to 2 cm. wide, ovate to lanceolate, cordate-clasping at base, rather abruptly acuminate, scabrous on the upper surface, sparsely hispid on both surfaces, ciliate at the base; panicles exserted or included at base, 3 to 7 cm. long, half to two-thirds as



wide, ovoid in outline, the main axis pilose, the numerous delicate but rather stiff branches ascending at a uniform angle (in herbarium specimens the branches conspicuously parallel), the numerous but not crowded



FIG. 148.—*P. hirtum*. From type specimen.

spikelets recurved at right angles on capillary pedicels; spikelets 1.2 mm. long, about 0.7 mm. wide, strongly plano-convex, turgid; first glume nearly as long as the spikelet, 3-nerved, narrow, covering the middle internerves of the sterile lemma, thin in texture and so closely appressed as to be usually invisible, sparsely hispid; second glume inflated, gibbous, pointed, 5-nerved, papillose-hispid, at maturity subindurate, the hairs stiffening and as much as 1 mm. long; sterile lemma equaling the second glume and inclosing a 2-keeled palea, 5-nerved, glabrous, the two middle internerves thin; fruit 1 mm. long, 0.6 mm. wide, very turgidly plano-convex, at first white, at maturity brown, sparsely sprinkled with minute globular hairs.

The spikelets of this unique species at maturity look like tiny burs or, as Lamarck says, like the "seeds of *Daucus*." The bristly second glume sometimes falls, leaving the turgid fruit, together with the first glume and sterile lemma, attached to the pedicel.

#### DISTRIBUTION.

Damp shady places, Trinidad to Brazil.

TRINIDAD: Arima, *Hitchcock* 10310. Piarco Savanna, *Hitchcock* 10363. St. Joseph, *Hitchcock* 10177. Port of Spain, *Hitchcock* 10320. Without locality, *Bot. Gard. Herb.* 3194.



FIG. 149.—Distribution of *P. hirtum*.

#### EXCLUDED SPECIES.

The study of genera allied to *Panicum* and the examination of a large number of type specimens has resulted in the identification of most of the species of North America included now or in the past by some authors in *Panicum*. Besides the valid species and the names accounted for in synonymy within the genus *Panicum* there are a great many names that, according to our present conception of the genera of Paniceae, are referable to other genera. While the list is not complete it is so nearly complete as to enable us to account for almost all the names of North American species that have been referred to *Panicum*. The second name in the column merely indicates the genus to which the species belongs. In no case is any name in the following list a transfer of a species or a new combination. In many cases the name, if transferred to the genus indicated, would be untenable.



- Panicum acutum* Rasp. *Reimarochloa*.  
*adscendens* H. B. K. *Syntherisma*.  
*adustum* Nees. *Syntherisma*.  
*africanum* Trin. *Oplismenus*.  
*agglutinans* Kunth. *Lasiacis*.  
*alabamense* Trin. *Paspalum*.  
*alopecuroides* L. *Pennisetum*.  
*alopecuroideum* L. *Pennisetum*.  
*alopecuroideum* Walt. *Chaetochloa*.  
*alopecurus* Lam. *Pennisetum*.  
*alsinoides* Griseb. *Ichnanthus*.  
*americanum* L. *Pennisetum*.  
*amphistemon* Wright. *Scutachne*.  
*amplexicaule* Rudge. *Hymenachne*.  
*amplifolium* Steud. *Chaetochloa*.  
*anomalum* Walt. *Chaetochloa*.  
*anthaenantia* Kuntze. *Anthaeantia*.  
*antillarum* Poir. *Pennisetum*.  
*aquaticum* Bosc. *Sacciolepis*.  
*aquaticum* Muhl. *Sacciolepis*.  
*arborescens* Sieber. *Lasiacis*.  
*arbusculum* Sieber. *Isachne*.  
*aristatum* Macf. *Echinochloa*.  
*arundinaceum* Swartz. *Isachne*.  
*aturense* H. B. K. *Homolepis*.  
*aureum* Trin. *Axonopus*.  
*auriculatum* Willd. *Hymenachne*.  
*autumnale* Bosc. *Leptoloma*.  
*badium* Scribn. & Merr. *Syntherisma*.  
*bambusioides* Desv. *Lasiacis*.  
*barbatum* Lam. *Chaetochloa*.  
*berchtholdiae* Doell. *Chaetium*.  
*bermudianum* Steud. *Sacciolepis*.  
*berteronianum* Schult. *Chaetochloa*.  
*bifidum* Bertol. *Paspalum*.  
*blepharophorum* Presl. *Homolepis*.  
*brachiatum* Poir. *Chaetochloa*.  
*brachyphyllum* Steud. *Syntherisma*.  
*brevifolium* Kunth. *Syntherisma*.  
*buckleyanum* Vasey. Error in Index Kewensis for *Paspalum*.  
*californicum* Benth. *Valota*.  
*campylostachyum* Hack. *Thrasya*.  
*caudatum* Lam. *Chaetochloa*.  
*caudatum* Salzm. *Sacciolepis*.  
*cenchroides* Rich. *Pennisetum*.  
*cenchroides* Ell. *Cenchrus*.  
*cernuum* Willd. *Chaetochloa*.  
*chaetium* Steud. *Chaetium*.  
*chauvinii* Steud. *Lasiacis*.  
*chrysites* Steud. *Axonopus*.  
*chrysoblephare* Steud. *Axonopus*.  
*chrysodactylon* Trin. *Axonopus*.  
*cognatum* Schult. *Leptoloma*.



- Panicum colonum* L. *Echinochloa*.  
*compactum* Swartz. *Lasiacis*.  
*compositum* Nees. *Chaetochloa*.  
*compressum* Balb. *Chaetochloa*.  
*ceresia* Kuntze. *Paspalum*.  
*ciliatiflorum* Wood. *Anthaenantia*.  
*cirrhosum* Scribn. & Merr. *Chaetochloa*.  
*confertum* Desv. ? *Isachne*.  
*corrugatum* Ell. *Chaetochloa*.  
*crinitum* Willd. *Pennisetum*.  
*crusardeae* Willd. *Chaetochloa*.  
*cruscorvi* L. *Echinochloa*.  
*crusgalli* L. *Echinochloa*.  
     *aristatum* Pursh. *Echinochloa*.  
     *hispidum* Ell. *Echinochloa*.  
     *mite* Pursh. *Echinochloa*.  
     *muticum* Ell. *Echinochloa*.  
     *purpureum* Pursh. *Echinochloa*.  
     *sabulicola* Trin. *Echinochloa*.  
*cruspavonis* Nees. *Echinochloa*.  
*cubense* Steud. *Oplismenus*.  
*cultratum* Trin. *Thrasya*.  
*curvinerve* Hack. *Syntherisma*.  
*dactylon* L. *Capriola*.  
*decumbens* Roem. & Schult. *Paspalum*.  
*densispica* Poir. *Pennisetum*.  
*digitarioides* Rasp. *Paspalum*.  
*dispermum* Lam. *Isachne*.  
*dissectum* L. *Paspalum*.  
*dissitiflorum* Steud. *Chaetochloa*.  
*divaricatum* Kunth. *Lasiacis*.  
*divaricatum* L. *Lasiacis*.  
     *glabrum* Kuntze. *Lasiacis*.  
     *latifolium* Fourn. *Lasiacis*.  
     *puberulum* Griseb. *Lasiacis*.  
     *stenostachyum* Griseb. *Lasiacis*.  
*divaricatum* Michx. *Festuca*.  
*divergens* Muhl. *Leptoloma*.  
*domingense* Zucc. *Syntherisma*.  
*drummondii* Vasey. Error in Index Kewensis for *Paspalum*.  
*duchaissingii* Steud. *Valota*.  
*dumetorum* A. Rich. *Chaetochloa*.  
*durum* Griseb. *Scutachne*.  
*echinatum* Willd. *Echinolaena*.  
*echinolaena* Nees. *Echinolaena*.  
*eggersii* Hack. *Valota*.  
*elliottianum* Schult. *Sacciolepis*.  
*erianthum* Poir. *Anthaenantia*.  
*falsum* Steud. *Valota*.  
*fasciculatum* Lam. *Oplismenus*.  
*fasciculiflorum* Steud. *Oplismenus*.  
*filiforme* L. *Syntherisma*.



*Panicum fimbriatum* Presl. *Syntherisma*.

*setigerum* Fourn. *Syntherisma*.

*firmum* Kunth. *Oryzopsis*.

*flavescens* Sieb. *Eriochloa*.

*floridanum* Trin. *Paspalum*.

*fluviatilis* Nees. *Sacciolepis*.

*fragile* Kunth. *Leptoloma*.

*francoi* Steud. *Oplismenus*.

*frumentaceum* Roxb. *Echinochloa*.

*frumentaceum* Salisb. *Holcus*.

*furcellatum* S. Moore. *Paspalum*.

*fuscescens* Willd. *Chaetochloa*.

*fusciflorum* Steud. *Leptocoryphium*.

*fuscum* Sieber. *Lasiacis*.

*gavanianum* Steud. *Valota*.

*geniculatum* Lam. *Chaetochloa*.

*georgicum* Spreng. *Eriochloa*.

*gibbum* Ell. *Sacciolepis*.

*glaberrimum* Ell. *Chaetochloa*.

*glabrum* Gaud. *Syntherisma*.

*mississippiense* Gattinger. *Syntherisma*.

*glandulosum* Nees. *Echinolaena*.

*glaucescens* H. B. K. *Isachne*.

*glaucescens* Nees. *Syntherisma*.

*glaucescens* Salzm. *Chaetochloa*.

*glaucescens* Willd. *Isachne*.

*glaucum* L. *Pennisetum*.

*glaucum* Rupr. *Chaetochloa*.

*glaucum* Steud. *Chaetochloa*.

*flavescens* Ell. *Chaetochloa*.

*purpurascens* Ell. *Chaetochloa*.

*glutinosum* Lam. *Lasiacis*.

*gracilentum* Poir. *Festuca*.

*gracillimum* Scribn. *Syntherisma*.

*grisebachii* Nash. *Lasiacis*.

*grossum* Salisb. *Echinochloa*.

*hamiltonii* Kunth. *Syntherisma*.

*heteranthum* Link. *Echinolaena*.

*hirtellum* L. *Oplismenus*.

*hirtellum* Walt. *Echinochloa*.

*hirticalycinum* Bosc. *Anthaenantia*.

*hirticalycum* Bosc. *Echinochloa*.

*hirtum* Willd. *Isachne*.

*hispidum* Muhl. *Echinochloa*.

*holciforme* Steud. *Echinochloa*.

*horizontale* G. F. W. Meyer. *Syntherisma*.

*horridum* Salzm. *Echinochloa*.

*humboldtianum* Kuntze. *Paspalum*.

*humifusum* Kunth. *Syntherisma*.

*hydrophilum* Schult. *Sacciolepis*.

*hymenachne* Desv. *Hymenachne*.

*ichnodes* Griseb. *Ichnanthus*.

*ignoratum* Kunth. *Anthaenantia*.



- Panicum imberbe* Poir. *Chaetochloa*.  
*immersum* Trin. *Axonopus*.  
*inaequivalve* Kuntze. *Paspalum*.  
*incertum* Bosc. *Echinochloa*.  
*insulare* G. F. W. Meyer. *Valota*.  
*ischaemum* Schreb. *Syntherisma*.  
*isocalycinum* Meyer. *Homolepis*.  
*italicum* L. *Chaetochloa*.  
*jurgensenii* Scribn. & Merr. *Chaetochloa*.  
*lachnanthum* Torr. *Valota*.  
*laevigatum* Lam. *Chaetochloa*.  
*laevigatum* Ell. *Chaetochloa*.  
*laevigatum* Muhl. *Chaetochloa*.  
*lagascae* Kuntze. *Paspalum*.  
*lagopus* Willd. *Eriochrysis*.  
*lagotis* Trin. *Ichnanthus*.  
*lanatum* Rottb. *Valota*.  
*lanatum* Swartz. *Lasiacis*.  
     *sorghoideum* Hamilt. *Lasiacis*.  
*langei* Fourn. *Homolepis*.  
*laterale* Presl. *Olyra*.  
*leandri* Trin. *Brachiaria*.  
*leucites* Trin. *Syntherisma*.  
*leucocomum* Scribn. *Syntherisma*.  
*leucophaeum* H. B. K. *Valota*.  
*liebmannianum* Fourn. *Lasiacis*.  
     *depauperatum* Fourn. *Lasiacis*.  
*lindeni* Fourn. *Ichnanthus*.  
*lineare* L. *Syntherisma*.  
*lineare* Krock. *Syntherisma*.  
     *mississippiense* Gattinger. *Syntherisma*.  
*linkianum* Kunth. *Syntherisma*.  
*litorale* Kuntze. *Paspalum*.  
*lioliceum* Lam. *Oplismenus*.  
*lioliiforme* Hochst. *Mesosetum*.  
*longiflorum* Trin. *Homolepis*.  
*longisetum* Torr. *Echinochloa*.  
*longispicula* Doell. *Homolepis*.  
*lutescens* Weigel. *Chaetochloa*.  
*macrostachya* Nees. *Chaetochloa*.  
*maculatum* Aubl. *Lasiacis*.  
     *pilosum* Fourn. *Lasiacis*.  
*malacophyllum* Kuntze. *Paspalum*.  
*martinicense* Griseb. *Lasiacis*.  
*mayarense* Wright. *Ichnanthus*.  
*melicarium* Michx. *Panicularia*.  
*melicarium* Muhl. *Sporobolus*.  
*melinis* Trin. *Melinis*.  
*mexicanum* Scribn. & Merr. *Chaetochloa*.  
*michauxianum* Schult. *Eriochloa*.  
*michauxii* Poir. *Eriochloa*.  
*minutiflorum* Rasp. *Melinis*.  
*molle* Michx. *Eriochloa*.



- Panicum mollissimum* Kunth. *Syntherisma*.  
*monobotrys* Trin. *Paspalum*.  
*monostachyum* H. B. K. *Paspalum*.  
*montanum* Poit. *Ichnanthus*.  
*multinerve* Desv. *Isachne*.  
*muricatum* Michx. *Echinochloa*.  
*myosurus* Rich. *Sacciolepis*.  
*myurus* Lam. *Sacciolepis*.  
*neesii* Kunth. *Syntherisma*.  
*nemorale* Schrad. *Ichnanthus*.  
*nemorosum* Swartz. *Ichnanthus*.  
*nemorosum* Willd. *Echinolaena*.  
*nudum* Walt. *Leptoloma*.  
*nuttallianum* Steud. *Oplismenus*.  
*oaxacense* Steud. *Lasiacis*.  
*obtectum* Presl. *Paspalum*.  
*occidentale* Nieuwl. *Chaetochloa*.  
*onurus* Willd. *Chaetochloa*.  
*orinocense* Willd. *Lasiacis*.  
*oxyanthum* Steud. *Reimarochloa*.  
*pallens* Swartz. *Ichnanthus*.  
*palmeri* Vasey. *Ixophorus*.  
*palmifolium* Poir. *Chaetochloa*.  
*paniculatum* Kuntze. *Paspalum*.  
*paniculiferum* Steud. *Chaetochloa*.  
*paractaenoides* Trin. *Chaetochloa*.  
*parciflorum* Steud. *Oplismenus*.  
*patentissimum* Roem. & Schult. *Festuca*.  
*penicillatum* Willd. *Chaetochloa*.  
*petrosum* Trin. *Thrasya*.  
*phaeocarpum drummondianum* Nees. *Syntherisma*.  
*phaeothrix* Scribn. *Syntherisma*.  
*phleiforme* Presl. *Sacciolepis*.  
*pittieri* Hack. *Valota*.  
*plantagineum* Link. *Brachiaria*.  
*platyphyllum* Munro. *Brachiaria*.  
*plicatulum* Kuntze. *Paspalum*.  
*polyrrhizum* Presl. *Paspalum*.  
*polystachion* Muhl. *Chaetochloa*.  
*polystachyum* Presl. *Hymenachne*.  
*praegnans* Steud. *Lasiacis*.  
*pringlei* Vasey. *Ixophorus*.  
*procerrimum* Hack. *Lasiacis*.  
*prorepens* Steud. *Oplismenus*.  
*pulchrum* Willd. *Axonopus*.  
*pungens* Poir. *Echinochloa*.  
*purpurascens* H. B. K. *Chaetochloa*.  
*radicosum* Presl. *Syntherisma*.  
*rariflorum* Lam. *Orthoclada*.  
*rariflorum* Presl. *Chaetochloa*.  
*restitutum* Steud. *Chaetochloa*.  
*rhizophorum* Fourn. *Lasiacis*.  
*rigens* Swartz. *Isachne*.



*Panicum rigidifolium* Kunth. Isachne.

*rigidifolium* Trin. Sacciolepis.

*roseum* Steud. Tricholaena.

*rottboellioides* H. B. K. Mesosetum.

*rufum* Kunth. Anthaenantia.

*rugelii* Griseb. Lasiacis.

*ruscifolium* H. B. K. Lasiacis.

*sabulicola* Nees. Echinochloa.

*saccharatum* Buckl. Valota.

*sacchariflora* Steud. Valota.

*saccharoides* A. Rich. Valota.

*saccharoides* Kunth. Paspalum.

*saccharoides* Trin. Tricholaena.

*sanctae-marthae* Steud. Oplismenus.

*sanguinale* L. Syntherisma.

*simpsoni* Vasey. Syntherisma.

*scabrifolium* Nees. Chaetochloa.

*scandens* Trin. Chaetochloa.

*scariosum* Trin. Lasiacis.

*schaffneri* Kuntze. Paspalum.

*scheelii* Steud. Chaetochloa.

*schiedeanum* Trin. Paspalum.

*schiedei* Spreng. Senites.

*schlechtendalii* Fourn. Ichnanthus.

*monstrosum* Fourn. Ichnanthus.

*schultesii* Steud. Oplismenus.

*scindens* Nees. Echinochloa.

*semirugosum* Nees. Chaetochloa.

*senescens* Trin. Paspalum.

*sericatum* Steud. Eriochloa.

*serotinum* Trin. Syntherisma.

*setarium* Lam. Oplismenus.

*setosum* Swartz. Chaetochloa.

*simpsoni* Beal. Syntherisma.

*sloanei* Griseb. Lasiacis.

*sorghoideum* Desv. Lasiacis.

*speciosum* Nees. Chaetochloa.

*spectabile* Nees. Echinochloa.

*squamatum* Fourn. ? Paspalum.

*stipatum* Presl. Syntherisma.

*striatum* Lam. Sacciolepis.

*strumosum* Presl. Sacciolepis.

*subspicatum* Desv. ? Sacciolepis.

*sulcatum* Aubl. Chaetochloa.

*swartzianum* Hitchc. Lasiacis.

*sylvaticum* Lam. Oplismenus.

*tenax* Rich. Chaetochloa.

*thrasya* Trin. Thrasya.

*thrasyoides* Trin. Thrasya.

*trachyspermum* Nees. Isachne.

*trinii* Kunth. Sacciolepis.

*trinii* Mor. Error in Index Kewensis for Echinolaena.

*triquetrum* Willd. Chaetochloa.

*triticeum* Willd. Cyperaceae.



- Panicum tumescens* Trin. Homolepis.  
    *uncinatum* Raddi. Echinolaena.  
    *unispicatum* Scribn. & Merr. Paspalum.  
    *velutinum* Bosc. Syntherisma.  
    *ventenatii* Steud. Chaetochloa.  
    *versicolor* Nieuwl. Chaetochloa.  
    *verticillatum* L. Chaetochloa.  
    *vestitum* Kunth. Valota.  
    *vilvoides* Trin. Sacciolepis.  
    *viride* L. Chaetochloa.  
    *viridiflorum* Nees. Homolepis.  
    *vulpisetum* Lam. Pennisetum.  
    *walteri* Pursh. Echinochloa.

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# STUDIES OF TROPICAL AMERICAN FERNS—NO. 6.

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By WILLIAM R. MAXON.

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## INTRODUCTION.

The present number of this series<sup>1</sup> is devoted mainly to a consideration of three groups of *Polypodium* whose species have for the most part been greatly misunderstood. The positive identification of many of the species depends largely upon a set of characters which until recent years have received scant attention, namely, the points of distinction afforded by the scales of the rhizome, or of the lamina, or of both. The rhizome scales are, for example, of especial importance in the group of *Polypodium trichomanoides*, as shown hereafter; and as studies of other groups within this genus have progressed, it has become more and more clear that in the scales or paleæ of the rhizome are to be found in general the most definite, constant, and readily available characters of all for the distinction of closely allied species. In some groups, as in that of *P. trichomanoides*, the very existence of these characters would pass unsuspected in a casual examination because of the general similarity of the plants in gross morphology; and the confusion which long prevailed among the species of this particular group is in fact traceable largely to this circumstance.

Besides the structural differences just mentioned, and correlated with them, there are peculiarities of habit, of venation and outline, and of several trichome structures of the frond which, under the former and more general method of study, passed as individual or regional variations but which evidently are to be regarded as important substantiating characters. These may appear among related species in various combinations. In preparing keys primarily for the identification of species emphasis must, therefore, be placed now upon one set of characters, now upon another, preference naturally being given to those which may be made out readily; but any synoptical treatment which pretends to completeness will certainly take account of scale structure in some detail. No further explanation need be offered for the frequent use and mention of relatively minute characters of this sort.

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<sup>1</sup> Contr. U. S. Nat. Herb. 10: 473–508. pls. 55, 56. March 30, 1908. Ibid. 13: 1–43. pls. 1–9. June 30, 1909. Ibid. 16: 25–62. pls. 18–34. June 19, 1912. Ibid. 17: 133–177. pls. 1–10. June 20, 1913. Ibid. 17: 391–425. pls. 11–23. January 21, 1914.



**POLYPODIUM TRICHOMANOIDES AND ITS AMERICAN ALLIES.**

The name *Polypodium trichomanoides*, given by Swartz in 1788 to a common plant of the Blue Mountains of Jamaica, was often applied very loosely by later writers and, although various related forms were described as valid species from time to time, the characters of these were not well understood, and there was little attempt to correlate them until the appearance in 1905 of an excellent paper by Hieronymus upon several groups of *Polypodium*.<sup>1</sup> To this author is due the credit of establishing the relationship and distinctive characters of a majority of the species in the group, as defined by him, and of demonstrating the usefulness and value of the minute but obvious structural differences of the rhizome scales. These characters, which are constant, can mostly be made out by means of a hand lens, although for greater accuracy and for the sake of repeated observation it is far preferable to preserve the scales as permanent microscopic mounts.

In the present paper, which is to a certain extent supplementary to that of Hieronymus, the group of *P. trichomanoides* is somewhat enlarged in scope, and several of Jenman's species which were overlooked or omitted by Hieronymus are also included, as well as others which have since been described by Christ, Rosenstock, Hieronymus, and the writer. Brief critical notes upon these are given in the following pages.

Strictly delimited, the group should include only those species which have the general facies and particularly the long-setose vestiture of *P. trichomanoides*, the principal characters of the plants being a smallish ascending or erect rhizome, with fulvous to reddish brown, ciliate or toothed rhizome scales, the few fronds mostly 3 to 15 cm. long, short-stipitate, slender, the lamina linear to narrowly linear-lanceolate, pinnately lobed to pinnatisect, the lobes or segments with a simple or once-forked vein, and invariably monosorous,<sup>2</sup> both the stipe and the lamina (especially upon the under side) being clothed with numerous long, spreading, stiffish, reddish hairs. Thus defined, the group would not include *P. micropteris*, *P. limula*, *P. hartii*, and *P. nutatum*, which have entire rhizome scales and fronds at most subsetulose, never long-setose. It would also exclude *P. grisebachii*, *P. perpusillum*, *P. mitchellae*, *P. shaferi*, *P. schenckii*, and *P. organense*, plants whose fronds range from subglabrous to pubescent, but are never long-setose with reddish hairs. All of these, however, have the small stature and monosorous lobes or segments of *P. trichomanoides* and its more immediate relatives and may therefore be included in this group. The first four mentioned above

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<sup>1</sup> Hedwigia 44: 78-105. 1905.

<sup>2</sup> See, however, under *P. blepharolepis* (page 556).



might with some justice be added to the group of *P. myosuroides*, treated in a former paper,<sup>1</sup> which they resemble in their rhizome scales, simple veins, and elongate sori. The whole series of species is of unusual interest from the fact that the individual unit characters (which are stated at length in the key) are variously combined in the different species. The points of specific difference are exact rather than comparative and so, with one or two exceptions noted in the text, the status of the species is fairly certain. Several of the species—e. g., *P. cookii*, *P. williamsii*, *P. basiattenuatum*, *P. trichomanoides*, *P. serricula*, and *P. setulosum*—have bifurcate or branched glandular hairs upon one or both sides of the lamina, the terminal cells being enlarged and more or less clavate. No examples of this structure in other families are known to the writer.

## KEY TO THE SPECIES.

Veins of all the segments simple.

Scales of the rhizome not ciliate.

Lamina slightly pubescent, or, if subsetulose the hairs mostly short, brittle, or caducous.

Segments minute, very oblique, long-decurrent..... 1. *P. micropteris*.

Segments larger, spreading, not long-decurrent.

Scales of the rhizome 0.6 to 1 mm. long, elongate-deltoid to ovate, acuminate to acutish, attached far above their base, the outermost 1 or 2 rows of cells minute and relatively thin-walled..... 2. *P. limula*.

Scales of the rhizome 1 to 3 mm. long, lance-linear to lance-oblong, attached at or near their base, not bordered by conspicuously smaller cells.

Segments narrowly oblong; scales mostly 8 to 12 cells broad, clathrate, the cells subquadrate to broadly oblong..... 3. *P. hartii*.

Segments deltoid-oblong; scales 13 to 20 cells broad, the cells mostly elongate-hexagonal, much smaller..... 4. *P. nutatum*.

Lamina conspicuously bristly-setose, the hairs long and persistent.

Plants of coarse aspect, the stipe 0.5 mm. thick; lamina merely pinnatifid, the segments coarse and rather broadly joined..... 5. *P. cookii*.

<sup>1</sup> Contr. U. S. Nat. Herb. 17: 398-406. pls. 11, 12. 1913.



- Plants very delicate, the stipe 0.1 mm. thick;  
lamina subpinnate throughout, the  
segments narrowed at the base, ob-  
scurely joined..... 6. *P. williamsii*.
- Scales of the rhizome freely long-ciliate..... 7. *P. caucanum*.
- Veins of the fertile (and sometimes also the sterile) seg-  
ments forked; or, in nos. 9 and 15, the fertile spur  
commonly obsolete.
- Lamina nearly glabrous to pubescent, never long-  
setose with stiff reddish hairs.
- Scales of the rhizome entire; partition cell walls  
very thin.
- Leaf tissue delicate, translucent; scales 0.6 to  
1.3 mm. long..... 8. *P. grisebachii*.
- Leaf tissue coriaceous, opaque; scales mostly  
1.5 to 2 mm. long..... 9. *P. perpusillum*.
- Scales of the rhizome whitish-ciliate; partition  
cell walls strongly dark-sclerotic.
- Sporangia long-setose.
- Fronde 4 to 8 cm. long, delicately her-  
baceous; lobes 15 to 30 pairs..... 10. *P. mitchellae*.
- Fronde 1.5 to 3.5 mm. long, spongiöse-  
herbaceous; lobes 5 to 12 pairs,  
shorter, broader ..... 11. *P. shaferi*.
- Sporangia not setose.
- Fronde 2 to 5 (rarely 8) cm. long; lamina  
3 to 4 mm. broad, pinnatifid  
about three-fourths the distance to  
the rachis, the segments small,  
porrect, close, acutish..... 12. *P. schenckii*.
- Fronde 8 to 20 cm. long; lamina 4 to 9  
mm. broad, very obliquely lobed  
about half way to the rachis, the  
lobes large and rounded..... 13. *P. organense*.
- Lamina invariably reddish-setose, the hairs usually  
very long.
- Scales of the rhizome with occasional irregular  
teeth, these 1 to 3 cells broad.
- Fertile branch of vein usually long-produced;  
segments narrow, usually subdistant in  
drying, distinctly gibbous..... 14. *P. trichomanoides*.
- Fertile branch of vein short or (in no. 15)  
commonly obsolete, the sorus then  
sessile; segments broader, closer,  
never gibbous.
- Segments obliquely triangular or deltoid-  
oblong..... 15. *P. serricula*.
- Segments oblong, rounded at the apex.
- Lamina delicately herbaceous, co-  
piously long-setose; vein of fer-  
tile segments distinctly genicu-  
late..... 16. *P. basiattenuatum*.
- Lamina more or less spongiöse,  
sparingly setose, the hairs  
shorter; vein of fertile segments  
arcuate, decurved..... 17. *P. sherringii*.



Scales of the rhizome with bristle-like cilia.

Lamina pinnately lobed about halfway to the rachis..... 18. *P. andinum*.

Lamina pinnatifid to subpinnatisect.

Vein of the fertile segments forked at or very near its middle.

Rhizome stout, the scales linear, 1.5 to 3 mm. long; lamina up to 15 cm. long, pinnatifid, the segments joined by a broadish wing..... 19. *P. truncicola*.

Rhizome small, the scales lance-oblong, 1 mm. long or less; lamina not exceeding 8 cm., subpinnatisect.

Segments more than their width apart, oblique, long-decurrent, freely setose, the hairs up to 1 mm. long.. 20. *P. nanum*.

Segments less than their width apart, spreading, not decurrent, less strongly setose, the hairs much shorter..... 21. *P. daguense*.

Vein of the fertile segments forked distinctly below its middle, commonly in the basal fourth.

Cilia of the rhizome scales hyaline.... 22. *P. hyalinum*.

Cilia of the rhizome scales reddish brown.

Segments very oblique, long-decurrent; rhizome scales minute, with few cilia..... 23. *P. setulosum*.

Segments spreading; scales much larger, freely ciliate.

Soriferous veinlet of fertile segments at least half as long as the sterile; segments distinctly joined..... 24. *P. nimbatum*.

Soriferous veinlet of fertile segments one-third to one-fifth as long as the sterile; segments scarcely or not at all joined.

Lamina conspicuously setose beneath, especially among the sporangia; annulus 15 or 16-celled..... 25. *P. blepharodes*.

Lamina scantily setose beneath, the hairs shorter and more slender; annulus 13 or 14-celled..... 26. *P. taenifolium*.



1. *Polypodium micropteris* C. Chr. Ind. Fil. 545. 1906.*Xiphopteris setosa* Kaulf. Enum. Fil. 275. 1824.*Grammitis setosa* Presl, Tent. Pter. 208. 1836, not Blume, 1828.*Polypodium setosum* Mett. Abh. Senckenb. Ges. Frankfurt 2: 33. 1856, not Thunb. 1784, Först. 1786, nor Presl, 1836.

TYPE LOCALITY: Brazil.

DISTRIBUTION: Apparently confined to Brazil.

ILLUSTRATION: Raddi, Pl. Bras. pl. 22 bis. f. 3, 3a (as *Grammitis myosuroides*.)

The above synonymy shows the change of name made by Christensen to have been necessary for this species, which was redescribed by Hieronymus<sup>1</sup> under the previously accepted name *Polypodium setosum* Mett. Most of the material cited by the latter has been seen in fragments kindly forwarded to the writer by Dr. I. Urban. In addition there has been available a single specimen in the Underwood Fern Herbarium.

2. *Polypodium limula* Christ, Bull. Soc. Bot. Genève II. 1: 218. 1909.

PLATE 32.

TYPE LOCALITY: Marais de la Palma, Costa Rica, altitude 1,500 meters (*Pittier* 708).

DISTRIBUTION: Mountains of Panama and Costa Rica, at 700 to 1,650 meters altitude; reported also from Guatemala.

This species, which is the continental analogue of *P. hartii*, is related closely only to that species and *P. nutatum*.

The following specimens are in the U. S. National Herbarium:

COSTA RICA: Mossy trunks of trees, La Palma, alt. 1,450 to 1,550 meters, *Tonduz* 12595; *Maxon* 367, 476, 406 in part. La Guaba, San Isidro, *Jiménez* 271. Cañas Gordas, alt. 1,100 meters, *Pittier* 10976. Forests of Tablazo, *Pittier* 7948 in part. Without locality, *Wercklé*. Helechaes de General, valley of Diquís, alt. 700 meters, *Pittier* 12060.

PANAMA: Humid forest along the upper Caldera River, near Camp I, Holcomb's trail, above El Boquete, Chiriquí, alt. 1,450 to 1,650 meters, *Maxon* 5721. Above Penonomé, *Williams* 454.

EXPLANATION OF PLATE 32.—Specimens of a cotype collection, *Pittier* 12595 (U. S. Nat. Herb. no. 366022). Natural size.3. *Polypodium hartii* Jenman, Journ. Bot. Brit. & For. 24: 272. 1886. PLATE 33.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Jamaica and the Lesser Antilles, ascending to 1,800 meters.

A well marked species, to be compared only with *P. limula* and *P. nutatum*. There is, as Hieronymus has noted,<sup>2</sup> a wide variation in its scales, some of which measure a full 3 mm. in length.

The following specimens are in the U. S. National Herbarium:

GRENADA: Without locality, *Sherring* 156 in part.

GUADELOUPE: "Epiphyte, assez rare. Chemin des Bains-Jaunes à la savane à Mulets. Savane aux Ananas. Morne Pavillon (Trois-Rivieres). Alt. 700-1,080 meters. 1897. 1899." *Duss* 4372, 4145.

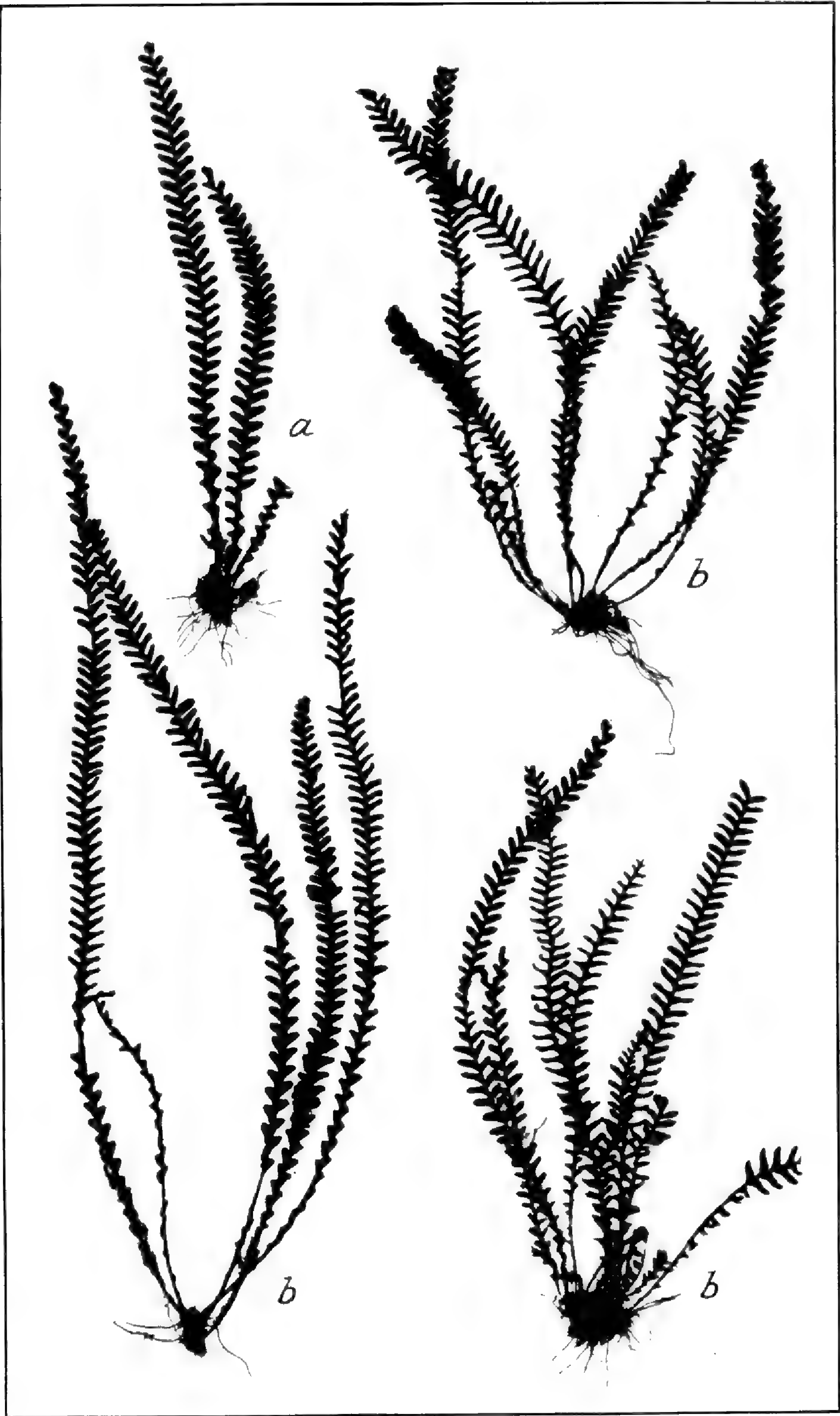
DOMINICA: Trois Pitons, *Lloyd* 797.EXPLANATION OF PLATE 33.—Two collections of *Polypodium hartii*: a, part of a Grenada specimen, *Sherring* 156 in part, received from Kew; b, Guadeloupe specimens, *Duss* "4372, 4145" (U. S. Nat. Herb. no. 524164). Both natural size.<sup>1</sup> Hedwigia 44: 91, 92. 1905.<sup>2</sup> Op. cit. 95.





POLYPODIUM LIMULA CHRIST.





POLYPODIUM HARTII BAKER.





POLYPODIUM WILLIAMSII MAXON.



4. *Polypodium nutatum* Jenman, Journ. Bot. Brit. & For. 24: 272. 1886.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Mountains of Jamaica and St. Vincent, ascending to 1,800 meters.

This species, the type specimens of which are presumably at Kew, is represented in the Jenman herbarium at New York by several specimens from St. Vincent (where, according to a note in Jenman's hand, it is "common above 2,000 ft. altitude") and a frond from Jamaica. These agree perfectly among themselves and with the description, the largest specimen being twice the height of *P. hartii* or *P. limula*. From these *P. nutatum* is readily distinguished by the key characters.

5. *Polypodium cookii* Underw. & Maxon, Contr. U. S. Nat. Herb. 17: 408. 1913.

TYPE LOCALITY: Near the Finca Sepacuité, Alta Verapaz, Guatemala (*Cook & Griggs* 80).

DISTRIBUTION: Known only from the original specimens.

A distinct and singular species, to be compared only with the next.

6. *Polypodium williamsii* Maxon, sp. nov.

PLATE 34.

Plants small and slender, subfasciculate, erect. Rhizome minute, 2 to 3 mm. long, 1 mm. or less in diameter, oblique, freely radicle, conspicuously paleaceous at the apex; scales numerous, tufted, spreading, yellowish brown in mass, oblong to ovate-oblong, 1 to 1.5 mm. long, 0.35 to 0.66 mm. broad, gland-tipped at the acutish or abruptly short-acuminate apex, entire, pale yellowish by transmitted light, the cells mostly oblong to quadrate, with thin walls; fronds 3 to 8, ascending, fasciculate, 2.5 to 5 cm. long; stipe 3 to 6 mm. long, 0.1 mm. in diameter, pale brown, bearing numerous short, deciduous, 3 or 4-celled branched glandular hairs; lamina linear, 2 to 4.5 cm. long, 3 to 6 mm. broad, scarcely narrowed at the base, slightly so at the apex, subpinnate throughout, both surfaces scantily long-setose, the hairs stiff, reddish brown, 1 to 1.6 mm. long; segments monosorous, 8 to 20 pairs, alternate (with a similar or slightly smaller terminal segment), oblique, subdistant, mostly inequilateral, broadly elliptical to rounded-obovate, entire (or, if shallowly notched above, often narrowly rhombic-ovate), usually narrower at the base, adnate, slightly decurrent, all faintly joined, the slender rachis greenish above, brownish and elevated beneath, distinctly flexuous throughout; veins of both the sterile and fertile segments simple, nearly straight, extending half or two-thirds the distance to the apex, ending in an elliptical hydathode; sori small, round, inframedial upon the segment, medial upon the vein, the receptacle minute, punctiform; sporangia glabrous, the annulus 15-celled. Leaf tissue delicately herbaceous, translucent, sparingly glandular beneath like the stipe.

Type in the U. S. National Herbarium, no. 700301, collected near Apolo, Bolivia, altitude about 1,500 meters, on rocks, July 7, 1902, by R. S. Williams (no. 1167).

Distributed as *Polypodium nanum* Fée, which it resembles in general appearance, but from which it departs widely in its entire rhizome scales and simple veins. The only American species of the *trichomanoides* group agreeing with *P. williamsii* in having entire rhizome scales, a long-setose lamina, and simple veins is the foregoing *P. cookii*, recently described from Guatemala; but that is a much coarser plant, with stipe 0.5 mm. in diameter, lamina merely pinnatifid, segments close and rather broadly joined, and sori larger, nearly basal, and confluent at maturity, the resemblance to *P. williamsii* being very remote.

EXPLANATION OF PLATE 34.—The type specimens. Natural size.



7. *Polypodium caucanum* Hieron. Bot. Jahrb. Engler 34: 503. 1904.

TYPE LOCALITY: Trunks of trees in humid forests near the Río Dagua, Province of Cauca, Colombia, altitude 2,300 meters (*Lehmann* 3257).

DISTRIBUTION: Nicaragua, Panama, Colombia, British Guiana, and Ecuador; ascending to 2,300 meters.

This species and *Polypodium cookii* are the only long-setose allies of *P. trichomanoides* in America which have the veins wholly simple. In *P. caucanum* the veins are merely arcuate, the small sorus being borne at a point a little less than half the distance from the base; in *P. cookii* they are geniculate at the sorus. The leaf tissue of both plants is rigidly herbaceo-coriaceous.

The following specimens are in the U. S. National Herbarium:

NICARAGUA: Without locality, *Wright*.

PANAMA: Humid forests of the upper Caldera watershed, between Camp I and the Divide, Holcomb's trail, above El Boquete, Chiriquí, alt. 1,650 to 1,925 meters, *Maxon* 5657.

BRITISH GUIANA: Upper slope of Mount Roraima, *im Thurn* 178. "Old Path," Mount Roraima, *im Thurn* 348.

8. *Polypodium grisebachii* Underw. in C. Chr. Ind. Fil. 531. 1906.

*Polypodium exiguum* Griseb. Fl. Brit. W. Ind. 701. 1864, not Heward, 1838, nor Fée, 1869.

TYPE LOCALITY: Summit of Blue Mountains, Jamaica, on trees (*Purdie*).

DISTRIBUTION: Higher peaks of the Blue Mountains, Jamaica, at 1,800 to 2,220 meters elevation; also in Martinique and Guadeloupe.

There is little to add to Hieronymus's excellent descriptive notes upon this species (which was wrongly taken up by him under the invalid name *Polypodium exiguum* Griseb.), except that the rhizome scales are not invariably ovate, but range to oblong-ovate or even linear-oblong. In Jamaica it occurs only upon the highest peaks and usually grows closely entangled in the deep mossy covering of forest trees.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Summit of Blue Mountain Peak, alt. 2,220 meters, *Maxon* 1512 (= *Underwood* 2580). Monkey Hill (above New Haven Gap), alt. 1,800 meters, *Maxon* 2751. Sir Johns Peak, alt. 1,850 meters, *Underwood* 3191. Locality not stated, *Hart* 74.

MARTINIQUE: Sommet de la Calabasse, etc., *Duss* 1655.

9. *Polypodium perpusillum* Maxon, Contr. U. S. Nat. Herb. 17: 409. 1913.

TYPE LOCALITY: Serra de Caraca, Minas Geraës, Brazil (*Ule*).

DISTRIBUTION: Known only from the original specimens.

ILLUSTRATION: Contr. U. S. Nat. Herb. 17: pl. 13. A.

At its place of publication this species was compared with *P. grisebachii*, which is perhaps its nearest relative, neither species being really of very close alliance to *P. trichomanoides*. *Polypodium perpusillum* is somewhat anomalous in its venation. Some fronds have most of both the fertile and the sterile veins simple, the receptacle of the sorus being evident as a slight protuberance about midway upon the upper side of the vein; others, which presumably represent a more mature state of the species, have some of both the fertile and the sterile veins forked. The species may, therefore, be placed here, rather than with *P. hartii*, *P. limula*, and *P. nutatum*, species which it does not at all resemble habitally.

10. *Polypodium mitchellae* Baker in Hemsl. Biol. Centr. Amer. Bot. 3: 664. 1885.

TYPE LOCALITY: Orange Walk, British Honduras (*Mrs. Mitchell*).



DISTRIBUTION: British Honduras, eastern Guatemala, and Nicaragua, ascending to 450 meters. Reported also from Costa Rica.

ILLUSTRATION: Contr. U. S. Nat. Herb. 17: pl. 14.

*Polypodium mitchellae* is most nearly related to *P. shaferi*, of Cuba, with which it was compared at the place of publication of the latter. The scale characters there given for it are, however, far from correct, having been taken from immature and broken scales. An examination of perfect material shows the scales of mature plants to be elongate-lanceolate to lance-ovate or sometimes broadly ovate, long-acuminate or usually attenuate, 1 to 1.7 mm. long, 0.36 to 0.63 mm. broad (excluding the long, divergent cilia). In form and dimensions, therefore, they approach those of *P. shaferi*, but their structure is different, the cells being broader and more irregular, with much thinner partition walls and much larger lumina. The two species are otherwise readily distinguishable by the characters previously pointed out.

The following specimens are in the U. S. National Herbarium:

GUATEMALA: Trunks of forest trees near Secanquím, Alta Verapaz, alt. 450 meters, *Maxon & Hay* 3195, 3213.

11. *Polypodium shaferi* Maxon, Contr. U. S. Nat. Herb. 17: 410. 1913.

TYPE LOCALITY: Near Camp La Gloria, south of Sierra Moa, Oriente, Cuba, among moss on roots and rocks (*Shafer* 8071).

DISTRIBUTION: Known only from the original specimens.

ILLUSTRATION: Contr. U. S. Nat. Herb. 17: pl. 13. B.

The position of *P. shaferi*, and especially its relationship to the last preceding species, were fully discussed at its place of publication.

12. *Polypodium schenckii* Hieron. Hedwigia 44: 87. 1905.

TYPE LOCALITY: Serra do Mar, near Joinville, Province of Santa Catharina, Brazil (*Schenck* 1243).

DISTRIBUTION: Known only from Brazil.

As previously noted<sup>1</sup> *Polypodium schenckii* belongs undoubtedly to the group of *P. trichomanoides* rather than to that of "*P. serrulatum*" (*P. duale*), in which it was placed by Hieronymus.

In addition to the material listed by Hieronymus the following specimens have been studied:

BRAZIL: Joinville, State of Santa Catharina, alt. 1,000 meters, *Schmalz* (Rosenstock, no. 139). Without locality, *Glaziou* 7491. Caldas, Minas Geraës, *Regnell* III. 1462\* (received as *P. peruvianum*).

13. *Polypodium organense* (Gardn.) Mett. Abh. Senckenb. Ges. Frankfurt 2: 39. 1857.

*Grammitis organensis* Gardn. in Hook. Icon. Pl. 6: pl. 509. 1843.

TYPE LOCALITY: Ravine near the summit of the Organ Mountains, Brazil (*Gardner* 5913).

DISTRIBUTION: Brazil.

ILLUSTRATIONS: Hook. Icon. Pl. 6: pl. 509; Fée, Crypt. Vasc. Brés. 1: pl. 78. f. 1.

A comparison of the scales of *P. organense* with those of *P. schenckii* suggests a much closer relationship between these two species than their pronounced differences in leaf form would indicate. The scales of *P. schenckii* have been described by Hieronymus. Those of *P. organense* are longer, broader, and similarly whitish-ciliate; the cells are arranged in 7 to 11 rows and the partition walls are much thicker, the lumen often obsolete.

<sup>1</sup> Contr. U. S. Nat. Herb. 17: 406, 410. 1913.



The following specimen, received from Copenhagen, is in the U. S. National Herbarium:

BRAZIL: Without locality, *Glaziou* 3573.

**14. *Polypodium trichomanoides* Swartz, Prodr. Veg. Ind. Occ. 131. 1788.**

PLATE 35.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Jamaica and eastern Guatemala, ascending to 2,200 meters. Ascribed also to British Guiana and Guadeloupe, probably in error.

ILLUSTRATION: Schkuhr, Krypt. Gewächse. 1: pl. 10.

In his treatment of this group, already mentioned, Hieronymus has described at length the peculiar rhizome scales of *P. trichomanoides*, and has shown very clearly their diagnostic value as a means of distinguishing this from those related species which have ciliate rhizome scales. In so doing, however, he has made the mistake of including in *P. trichomanoides* a Lesser Antilles form, described as *P. serricula* Fée, which seems to be a distinct species, and has wholly overlooked Jenman's *P. basiattenuatum* and *P. sherringii* from Jamaica. The scales of all four are too nearly alike to afford good distinctive characters, it is true. Still, the species may be distinguished easily by differences in the venation, cutting, texture, and vestiture of the fronds.

The general characters of *P. trichomanoides* will be evident from the illustration of a typical Jamaican plant in plate 35 and from Jenman's excellent description.<sup>1</sup> Aside from the stout rhizomes and the stiffly erect or shuttlecock habit of the very numerous rigid fronds, the most conspicuous and constant character lies in the strongly gibbous upper margin of the segments. Rarely is this condition lacking, and then only in certain fronds of immature plants or in the smaller fronds of mature individuals. The gibbous form of the segments is directly associated with the production of a slender elongate fertile branch. The sorus is borne distinctly below the tip of this branch, and the tips of both veinlets are invariably evident as hydathodes upon the upper surface.

*Polypodium trichomanoides* is readily distinguishable from *P. basiattenuatum* and *P. sherringii*. It is more easily confused with *P. serricula* Fée, a Lesser Antilles species merged with it by Hieronymus, as discussed below.

The following specimens of *P. trichomanoides* are in the U. S. National Herbarium:

JAMAICA: Vicinity of New Haven Gap, alt. 1,650 meters, on mossy trunks and branches of forest trees, *Maxon* 2626, 2627, 2687. Slopes of Monkey Hill (above New Haven Gap), alt. about 1,800 meters, *Maxon* 2745, 2752. Sir Johns Peak, alt. about 1,900 meters, *Underwood* 3175, 3196. Upper slopes of John Crow Peak, alt. 1,650 to 1,800 meters, *Maxon* 1348; *Clute* 78. Without precise locality, *Hart* 190, 258.

GUATEMALA: Near Coban, Alta Verapaz, alt. 1,350 meters, *von Türckheim* II. 2383.

EXPLANATION OF PLATE 35.—Medium-sized Jamaica specimens of *Polypodium trichomanoides* (*Maxon* 2687, U. S. Nat. Herb. no. 520663). Natural size.

**15. *Polypodium serricula* Fée, Gen. Fil. 238. 1852.**

TYPE LOCALITY: Guadeloupe.

DISTRIBUTION: Guadeloupe, Martinique, and Dominica, at 700 to 1,250 meters elevation.

ILLUSTRATION: Fée, Mém. Foug. 6: pl. 7. f. 1.

*Polypodium serricula* was described in 1852 from Guadeloupe specimens collected by L'Herminier and Perrottet and was figured by Fée two years later,

<sup>1</sup> Bull. Bot. Dept. Jamaica II. 4: 114. 1897.





POLYPODIUM TRICHOMANOIDES SWARTZ.





POLYPODIUM BASIATTENUATUM JENMAN.



only the original specimens being again cited. The illustration accords perfectly with several Lesser Antilles specimens at hand which show this to be a distinct species. Of these specimens one is in the U. S. National Herbarium (no. 692056); it is from Guadeloupe, Duss "4084, 4085, 4086," and came associated under this collective number with four individuals of *P. taenifolium*, the label reading "*P. trichomanoides* Sw." The other numbers, all in the Underwood Herbarium of the New York Botanical Garden, are as follows:

GUADELOUPE: Duss 4371 in part (the other element is *P. taenifolium*).

Duss "4084, 4085, 4086" in part (mixed with *P. hartii* and *P. taenifolium*). Several fragmentary specimens collected by L'Herminier (no. 106), presumably type material, and with them two fronds of *P. hartii* and two of *P. taenifolium*.

MARTINIQUE: Duss 1654 in greater part (excellent specimens, with one plant of *P. taenifolium*). Duss 1654b (two sheets, one of which is in part *P. hartii*).

DOMINICA: Laudat, Lloyd 121 in small part (the other specimens mostly *P. hartii*). Mount Diablotin, Lloyd 874. Mount Diablotin, alt. 900 meters, Lloyd 897.

From these specimens a complete description has been written for the North American Flora. Though manifestly of close alliance to *P. trichomanoides*, to which it is reduced by Hieronymus,<sup>1</sup> *P. serricula* has excellent characters for its recognition, differing not only in the shape of its segments but also in its fewer setae, its less rigid, thinner, and more translucent leaf tissue (*P. trichomanoides* having rigid, thick, herbaceous, and nearly opaque leaf tissue), and in its venation. In a few specimens the fertile vein branch is extended a short distance beyond the sorus and ends in a noticeable hydathode; but in most others the fertile spur of the vein is hardly visible, being in fact so short that the sorus is actually sessile upon the upper side of the main vein and chiefly overlies it, and a hydathode is usually not developed. The nongibbous, more or less triangular segments and the characteristic aspect of the plant alone ordinarily distinguish it from *P. trichomanoides*, however, for it agrees indifferently only with those few young or small fronds of the latter in which the gibbous form of the segments has not yet been developed.

**16. *Polypodium basiattenuatum*** Jenman, Bull. Bot. Dept. Jamaica II. 4: 114. 1897. PLATE 36.

TYPE LOCALITY: Blue Mountains, Jamaica.

DISTRIBUTION: Known only from the Blue Mountains of Jamaica, altitude 1,500 to 2,220 meters.

Following his description of this species, Jenman comments upon it as follows:

Common above 5,000 ft. altitude on the branches of trees; a much softer plant than any of its allies, from which it is further distinguished by its weaker habit, characteristically attenuated base of the fronds, the oblong broadly rounded, unlobed segments, lying obliquely side by side so close that the base of each is not expanded; the longer, softer, surface-hairs, which glisten in sunlight with a beautiful reddish fulvous hue, and the usually larger sori. Hitherto ascribed to the mainland *P. truncicola* Klotzsch, a stiffly erect species with deltoid segments set horizontally, like the teeth of a saw, but possessing the same beautiful, soft, silky vestiture.

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<sup>1</sup>Among other specimens cited by Hieronymus under *P. trichomanoides* are two from Guadeloupe, both determined by Mettenius as *P. serricula*, and a British Guiana specimen collected by Schomburgk, which has not been seen by the writer.



As may be noted from the key, however, the relationship of *P. basiattenuatum* with *P. truncicola* is not a very close one, the rhizome scales of the former entirely lacking the bristle-like cilia characteristic of *P. truncicola*. The latter is also in every respect a much coarser plant. *Polypodium basiattenuatum* grows in association with *P. trichomanoides*, but the two may be distinguished at a glance.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Summit of Blue Mountain Peak, alt. 2,000 to 2,200 meters, on mossy trunks and branches of trees, *Maxon* 1475, 1511, 1515; *Underwood* 1452, 1462. Slopes of Monkey Hill (above New Haven Gap), alt. 1,800 meters, *Maxon* 2573. Summit of Sir Johns Peak, alt. about 1,900 meters, *Underwood* 3188. Without locality, *Hart* 69.

EXPLANATION OF PLATE 36.—Characteristic specimens of *Polypodium basiattenuatum* (*Underwood* 1462, U. S. Nat. Herb. no. 521277). Natural size.

**17. *Polypodium sherringii* Baker, Journ. Bot. Brit. & For. 20: 326. 1882.**

TYPE LOCALITY: Newton district, Port Royal Mountains, Jamaica (*Sherring*).

DISTRIBUTION: Port Royal Mountains, Jamaica, altitude 1,200 to 1,500 meters.

The actual type of this species, which is at Kew, has not been seen by the writer, but there are photographs in the U. S. National Herbarium, the Underwood Herbarium, and the Herbarium of the Department of Agriculture at Hope Gardens, near Kingston, Jamaica, as well as an incomplete specimen in the Underwood Herbarium, presumably of the type collection,<sup>1</sup> from which a fairly complete description has been drawn for the North American Flora. It appears that this species is a close ally of *P. basiattenuatum*, from which it may be separated by the characters given in the key.

Jenman, who also has redescribed<sup>2</sup> *P. sherringii*, writes of its relationship, as follows:

Rare at 4,000–5,000 ft. altitude in the Port Royal Mountains in the Newton district on boughs of forest trees. This resembles *basiattenuatum* in the entire rounded lobes, decurrent and dwindling at the base of the fronds, but is more densely tufted, with short stiff coriaceous fronds, which are much less ciliate. The fronds are erect or erecto-spreading and are so stiff that in course of time the pagina decays, leaving the rigid black midribs standing mixed with the growing fronds. The rootstock in the specimen before me forms an upright tuft of matted fibres nearly finger thick.

**18. *Polypodium andinum* Hook. Second Cent. Ferns pl. 6. 1860.**

TYPE LOCALITY: Banks of the Rio Hondacha, Andes of Peru (*Jameson* 780).

DISTRIBUTION: Mountains of Ecuador, Peru, Colombia, and Costa Rica, ascending to at least 2,000 meters.

ILLUSTRATION: Hook. loc. cit.

The present species, which is clearly a member of the *trichomanoides* group, was well described and figured by Hooker. The scales are minute (0.75 to 1 mm. long), linear-deltoid from a rounded base, here 5 to 8 cells broad, the cells mostly oblong, thin-walled, translucent, pale rusty. The cilia are distinctly reddish brown and mostly longer than the width of the scale.

The following specimens, agreeing closely with Hooker's plate, are in the U. S. National Herbarium:

COSTA RICA: Near La Palma, alt. 1,450 to 1,550 meters, on trunk of a small forest tree, *Maxon* 392. Same locality, *Tonduz* 12648.

<sup>1</sup>An accompanying note in Dr. Underwood's hand reads as follows: "Mr. Sherring says specimen photographed was afterwards divided in three parts: One here [Jenman herbarium], one at Kew, and the balance with himself.—L. M. U., 1903."

<sup>2</sup>Bull. Bot. Dept. Jamaica II. 4: 113. 1897.



**19. *Polypodium truncicola* Klotzsch, Linnaea 20: 374. 1847.**

TYPE LOCALITY: Tovar, Venezuela (*Moritz* 252).

DISTRIBUTION: Venezuela to Ecuador. Ascribed also to Guatemala, probably in error.

Of this species, which is tolerably well known from its redescription by Mettenius and others, the following specimens are in the U. S. National Herbarium:

VENEZUELA: Mérida or Tovar, *Moritz* 333. Without locality, *Fendler* 211.

**20. *Polypodium nanum* Fée, Gen. Fil. 238. 1852.**

*Polypodium exiguum* Fée, Crypt. Vasc. Brés. 1: 89. 1869, not Heward, 1838, nor Griseb. 1864.

*Polypodium blanchetii* C. Chr. Bot. Tidsskr. 25: 78. 1902.

TYPE LOCALITY: French Guiana (*Leprieur*).

DISTRIBUTION: French Guiana, British Guiana, and Brazil.

ILLUSTRATION: Fée, Crypt. Vasc. Brés. 1: pl. 37. f. 1 (as *P. exiguum* Fée).

In his recent paper upon this group Hieronymus<sup>1</sup> has referred to this species specimens of five different collections, two of which (*Malme* 1696 and *Glaziou* 15753) are represented in the U. S. National Herbarium. A study of these and of several of *Leprieur*'s French Guiana plants, also in the National Herbarium, shows all to belong to a single species, as stated by Hieronymus.

Of the two other collections (not seen) one (*Schwacke* 5001) was determined by Christ as *P. exiguum* Fée, a "species" described and figured by Fée from a plant from Bahia (*Blanchet* 8). Hieronymus regards this as distinct from *P. nanum* and Christ's determination, therefore, as an error; but there is little to support such a view. The *Leprieur* specimens at hand are exactly similar to Fée's figure, save in the one particular of lacking the long stipes shown in that illustration; and it is probable that the specimen figured was either atypical or imperfect, or both. Moreover, Christensen in substituting the new name *P. blanchetii* for the *P. exiguum* of Fée has cited two of *Glaziou*'s Brazilian plants (10177 and 15753), the latter of which is included by Hieronymus under *P. nanum*. An example of this number in the National Herbarium, received from Copenhagen under Christensen's determination as *P. blanchetii* C. Chr., agrees very well with the *Leprieur* plants and serves to indicate that whatever *Blanchet*'s no. 8 (the type of *P. blanchetii*) may be, *P. blanchetii* as understood by Christensen is conspecific with *P. nanum*. *Glaziou*'s 10177 has not been seen by the writer nor, apparently, by Hieronymus.

The specimens mentioned as being in the U. S. National Herbarium are:

FRENCH GUIANA: Summo arborum muscis intermixtum in sylvis humidis,

Oyapok superius, June, 1833, *Leprieur* (as *Polypodium trichomanoides*).

BRAZIL: Serra da Chapada, Matto Grosso, June 18, 1894, *Malme* 1696.

Without exact locality, *Glaziou* 15753.

There are excellent British Guiana specimens of this species in the Underwood Herbarium, collected by Jenman in the region of the higher Demerara River.

**21. *Polypodium daguense* Hieron. Bot. Jahrb. Engler 34: 504. 1904.**

TYPE LOCALITY: Dense maritime forest near the Río Dagua, Province of Cauca, Colombia (*Lehmann* 1951).

DISTRIBUTION: Known only from the type collection.

The present species was described by Hieronymus previous to his revision of this group in 1905. It is distinguished easily from *P. nanum* by the characters stated in the key, and from *P. taenifolium*, its nearest relative, by the lesser size of all its leafy parts, by its shorter setæ, and by having the veins of the fertile segments forked toward the middle rather than near the base.

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<sup>1</sup> *Hedwigia* 44: 102, 103. 1905.



**22. *Polypodium hyalinum* Maxon, Contr. U. S. Nat. Herb. 17: 406. 1913.**

TYPE LOCALITY: Upper forested slopes of the Volcán de Barba, Costa Rica (*Pittier* 1928).

DISTRIBUTION: Known only from the original collection.

This species was fully compared with its allies at the original place of publication.

**23. *Polypodium setulosum* Rosenst. Repert. Nov. Sp. Fedde 10: 277. 1912.**

TYPE LOCALITY: El General, Costa Rica, altitude 656 meters.

DISTRIBUTION: Known only from Costa Rica.

The type of *P. setulosum*, collected by Tonduz, is Jiménez's no. 214, of which there are three fronds in the National Herbarium. The species is adequately described except as to venation. The veins of the sterile segments are either simple or forked below the middle, the proximal branch oblique and decidedly longer than in related species. The veins of the fertile segments are invariably forked, the very oblique proximal branch being fertile near its base and almost equaling the distal branch. Minute branched glandular hairs, similar to those of *P. trichomanoides*, *P. serriola*, and *P. basiattenuatum*, are borne sparingly upon the under surface of the leaf.

The following additional specimen, which is larger and not altogether typical in venation, is referred provisionally to this species:

COSTA RICA: San Cristóbal, *Wercklé* (ex herb. Jiménez).

**24. *Polypodium nimbatum* Jenman, Journ. Bot. Brit. & For. 24: 271. 1886.**

PLATE 37.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Mountains of Jamaica and Cuba, at 1,020 to 1,500 meters altitude; rare.

A small species with stout rhizomes and numerous densely tufted, short, narrow fronds, somewhat suggesting a reduced state of *P. truncicola*, from which it differs widely in venation and position of sori. Although grouped with *P. taenifolium* and *P. blepharodes* in the artificial key it has only a remote relationship to these species.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Without definite locality, the collector's name not stated (ex herb. Dept. Agric. Jamaica; determined by Jenman as *P. nimbatum*). Rose Hill, W. *Harris*, March 12, 1895 (determined by Jenman as *P. nimbatum*). Hardware Gap, July 30, 1907, *Fisher* 157.

CUBA: Without precise locality, *Wright* 1049 (fragments from specimens in the Gray Herbarium). Jiguarito Mountain, Sierra Maestra, alt. 1,020 meters, September 18, 1906, *Taylor* 540.

EXPLANATION OF PLATE 37.—Specimens of *Polypodium nimbatum*: A, one of five Jamaican specimens (probably the type collection) marked *Polypodium nimbatum* by Jenman, received from Herbarium of the Department of Agriculture, Jamaica; B, *Wright's* no. 1049, from Cuba, in the Gray Herbarium. Both natural size.

**25. *Polypodium blepharodes* Maxon, Contr. U. S. Nat. Herb. 17: 407. 1913.**

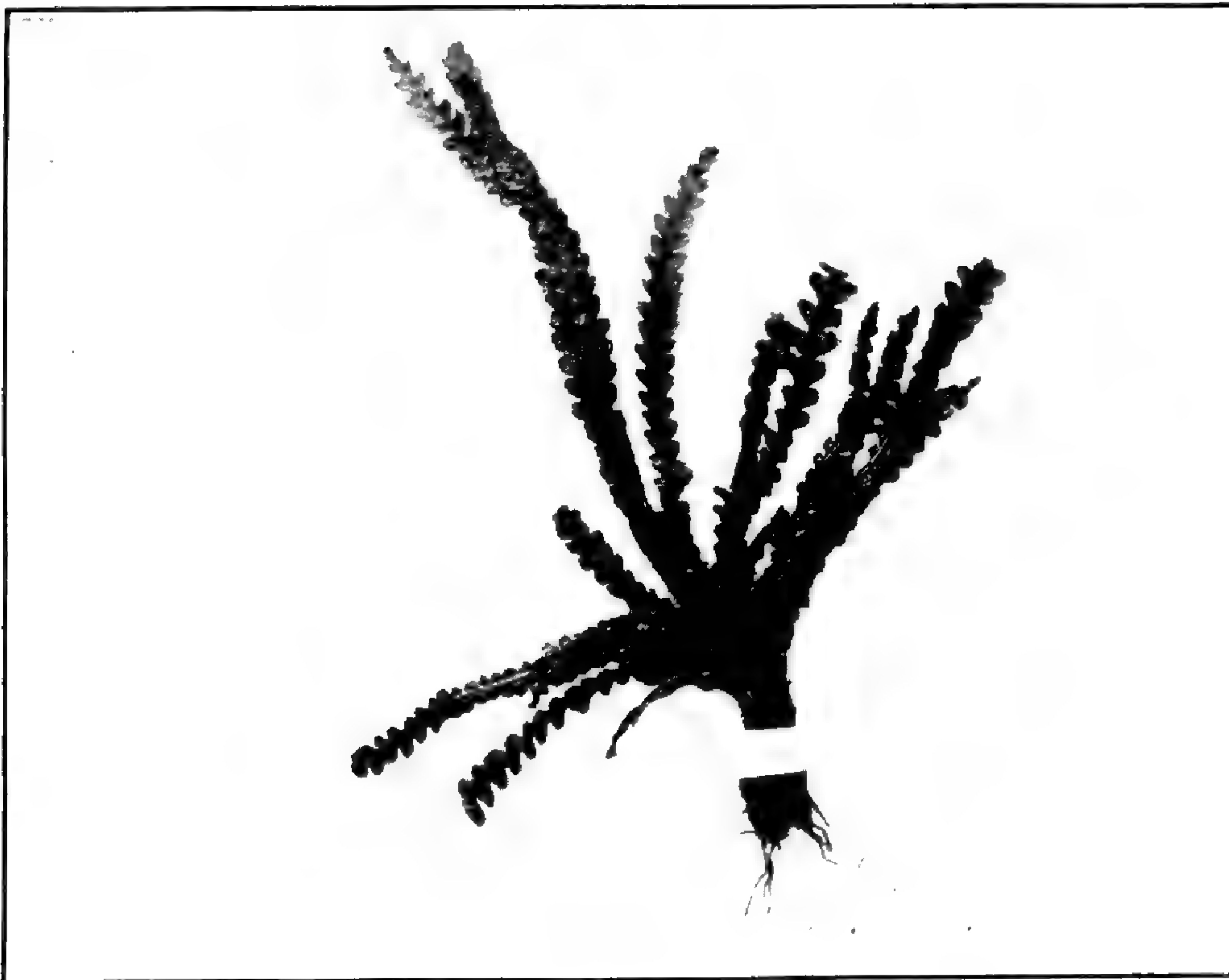
TYPE LOCALITY: Vicinity of La Palma, Costa Rica, altitude 1,450 to 1,550 meters, on tree stump at border of forest (*Maxon* 406).

DISTRIBUTION: Mountains of Panama, Costa Rica, and eastern Guatemala, ascending to 1,650 meters.

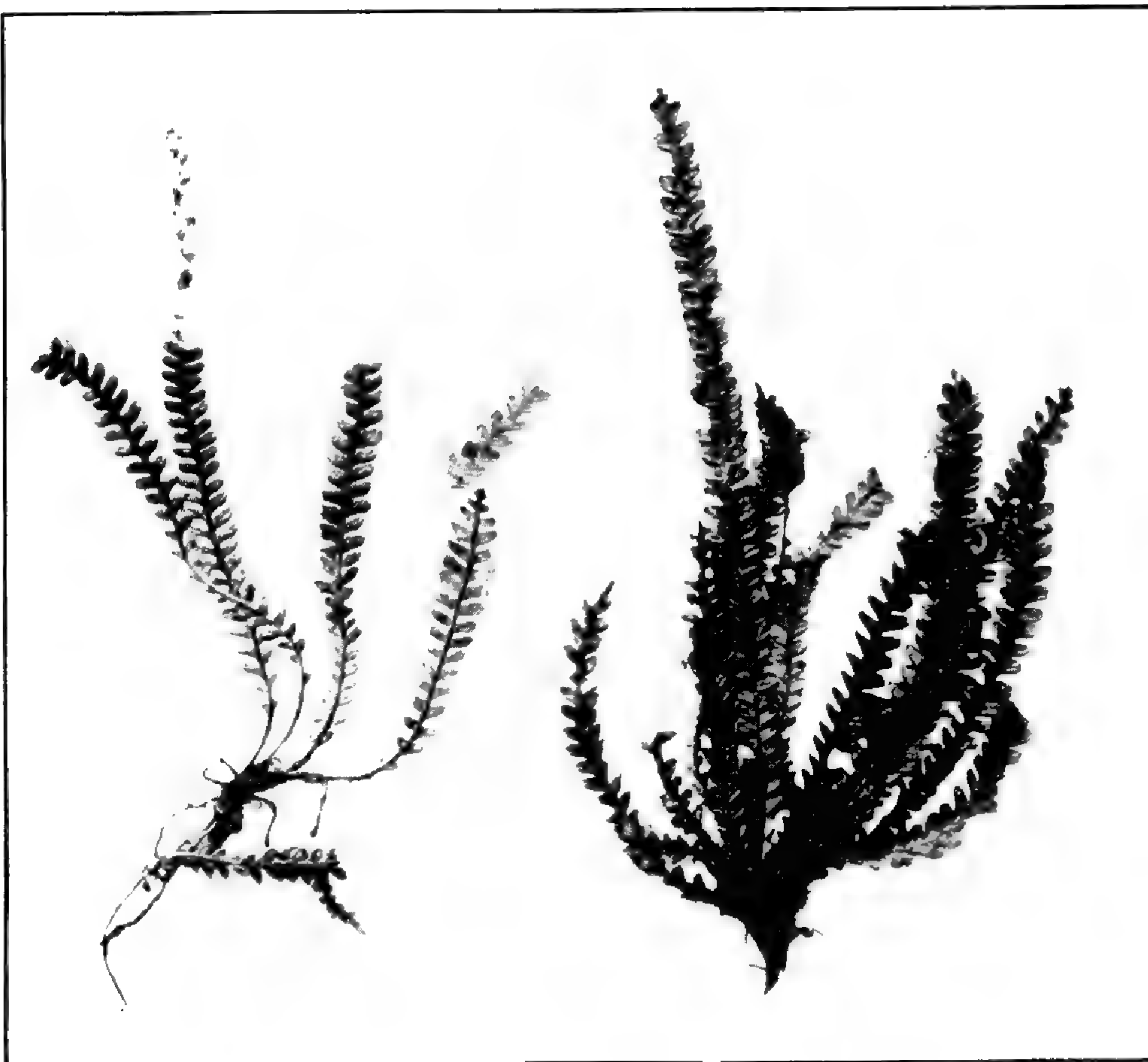
The relationship of *P. blepharodes* has previously been treated, with citation of the numerous specimens in the U. S. National Herbarium. The following additional collections may be listed:

COSTA RICA: Trail from San Ramón to Esparta, alt. 1,200 to 1,400 meters, *Brénes* 14214. Santiago, near San Ramón, alt. 1,200 to 1,300 meters, *Brénes* 14212.



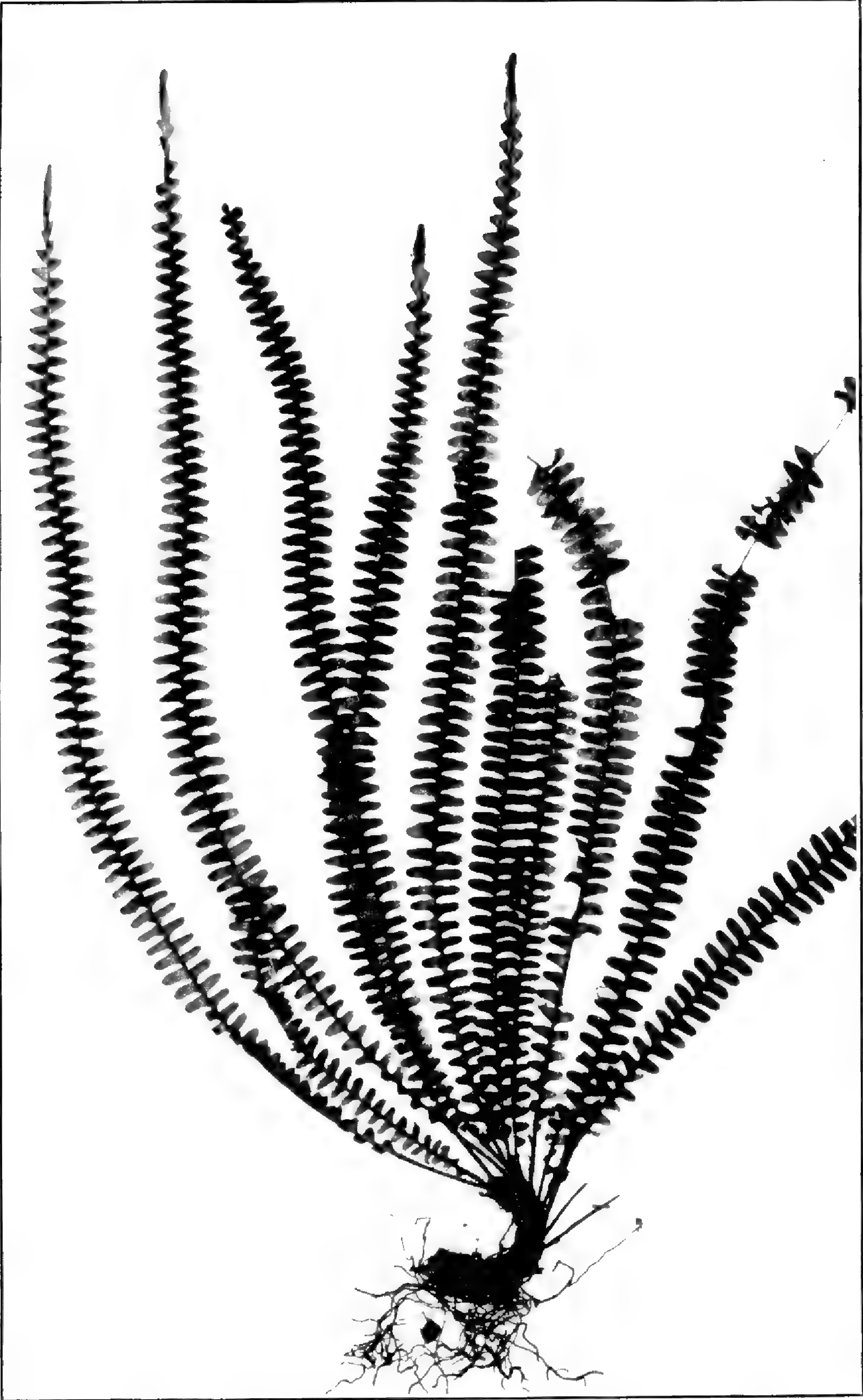


A. *POLYPODIUM NIMBATUM* JENMAN.



B. *POLYPODIUM NIMBATUM* JENMAN.





POLYPODIUM TAENIFOLIUM JENMAN.



PANAMA: Cerro Vaca, eastern Chiriquí, alt. 900 to 1,136 meters, *Pittier* 5371. Eastern slope of Mount Pírre, Province of Panama, alt. 1,350 meters, *Goldman* 1972. Cana and vicinity, alt. 1,650 meters, *Williams* 892. Above Penonomé, *Williams* 452.

26. *Polypodium taenifolium* Jenman, Bull. Bot. Dept. Jamaica II. 4: 114. 1897.

PLATE 38.

*Polypodium sintenisii* Hieron. Hedwigia 44: 101. 1905.

TYPE LOCALITY: Near Mount Moses, Jamaica, altitude 600 to 900 meters (*Syme*).

DISTRIBUTION: Jamaica, Porto Rico, Grenada, Montserrat, Martinique, Guadeloupe, and Trinidad; ascending to about 1,100 meters.

Jenman's description of *P. taenifolium* and the more elaborate description of *P. sintenisii* by Hieronymus agree very well, and a comparison of a specimen of the former<sup>1</sup> with typical material of *P. sintenisii* from Porto Rico, collected by Sintenis and others, leaves absolutely no doubt as to their identity. Unfortunately, *P. taenifolium* is exceedingly rare in Jamaica, so that the species is known chiefly from specimens collected in Porto Rico and the Lesser Antilles.

Of the Porto Rican specimens listed by Hieronymus under *P. sintenisii* only one (*Sintenis* 1796) is at hand, this according perfectly with the other specimens from Porto Rico cited below. Hieronymus studied Guadeloupe and Grenada collections also, of which only the latter (*Sherring* 156, in part) is represented in the National Herbarium. This last, which is more freely fertile than any of the Porto Rican plants seen, has the fertile segments narrowly triangular and lightly gibbous, their shape being directly dependent upon the pronounced fertility of the fronds. So also, in Duss's very fertile Martinique and Guadeloupe specimens (listed below) the fertile pinnae are rather strongly gibbous and the fertile vein-branches are accordingly much longer than in less fertile specimens, even attaining a length of one-third that of the distal branch, rather than one-fifth, as in Porto Rican specimens; they are also more oblique. Hieronymus's description must, therefore, be amended in this particular. The differences in venation are, perhaps, not wholly accounted for on the score of fertility, and it is possible that the Lesser Antilles plants represent a phase which with more abundant material will be found to represent a distinct species.

The following specimens are in the U. S. National Herbarium:

PORTO RICO: Sierra de Luquillo, in monte Jiménez, *Sintenis* 1796. Luquillo Mountains, *Wilson* 179; *Hioram* 342. Sierra de Naguabo, *Hess* 315; *Shafer* 2250.

MARTINIQUE: *Duss* 1654 in part.

GUADELOUPE: *Duss* 4084, 4085, 4086.

GRENADA: Without locality, *Sherring* 156 in part.

MONTSERRAT: Chaners Mountain, alt. 900 meters, *Shafer* 291.

There are also four excellent sheets of Trinidad specimens of this species in the Underwood Herbarium, New York Botanical Garden, three being numbered, respectively, 24, 202, and 6434, of the Trinidad Botanic Gardens Herbarium series.

EXPLANATION OF PLATE 38.—A medium-sized Porto Rico specimen of *Polypodium taenifolium* (*Hess* 315, U. S. Nat. Herb. no. 756055).

<sup>1</sup>This specimen is in the herbarium of the Department of Agriculture of Jamaica, Hope Gardens, near Kingston, Jamaica. It is marked in Jenman's handwriting as *P. taenifolium* and almost certainly is a part of the type.



## DOUBTFUL OR EXCLUDED SPECIES.

1. *POLYPODIUM ANTIOQUIANUM* Baker, Journ. Bot. Brit. & For. 19: 205. 1881.

This species, founded upon specimens collected from among mosses on forest trees, Antioquia, Colombia, altitude 1,500 meters (*Kalbreyer* 1703) and apparently represented in herbaria only by *Kalbreyer's* specimens, was wholly unknown to Hieronymus, who was inclined from description to regard it as a near relative of *P. trichomanoides*. An examination of a portion of the type (lent from Kew) shows, however, that it is not of the *trichomanoides* group but is related to *P. cultratum* and allied species. The segments are monosorous, as in *P. trichomanoides* and allies, but the sorus is apical, being situated at or near the end of the distal rather than the proximal branch of the usually once-forked vein.

2. *POLYPODIUM BLEPHAROLEPIS* C. Chr. Ind. Fil. Suppl. 58. 1913.

Described, originally as *P. gracillimum* Hieron.,<sup>1</sup> upon specimens collected between Quito and Mindo, Province of Pichincha, Ecuador (*Stübel* 747) and apparently known only from the type collection. According to description and figure it is most nearly related to *P. daguense*. It departs from other members of this group, as here treated, in sometimes having a second sorus upon some of the pinnae.

3. *POLYPODIUM GIBBOSUM* Fée, Mém. Foug. 6: 8. pl. 2. f. 2. 1854.

The original specimens of this species are said by Fée to have come from Oaxaca, Mexico, altitude 2,400 to 2,600 meters, and to have been received by him from the collector, Galeotti, under the name of *Polypodium delicatulum*, this, however, as described and figured by Martens and Galeotti, being a very different species of another rather large group, characterized by having numerous biserial sori. Fée, notwithstanding the obvious error of Galeotti's identification (to which he called attention) and the consequent uncertainty as to the correctness of the locality data of the specimen, nevertheless described it as a new species. His illustration shows a plant which, if of a less critical group, would be recognized without much difficulty; but as yet no similar Mexican specimen has come to light among the large collections made in that country of late years. The Galeotti specimen is very likely West Indian in origin and the Mexican locality data wholly wrong.

Hieronymus has associated<sup>2</sup> under the name *P. gibbosum* several specimens from Jamaica, Trinidad, Venezuela, and Martinique, all of which excepting the last mentioned (Martinique, *Duss* 1654) have been sent to the writer for comparison. They appear to represent more than one species, the one most resembling Fée's figure being Day's 233, from the vicinity of Newcastle, Jamaica. This plant is matched by two Jamaican specimens in the U. S. National Herbarium (*Safford* 10; *Maxon* 962). Although all three may represent *P. gibbosum*, this fact can not be substantiated without comparing them with Fée's actual type. Further consideration of them is, therefore, deferred for the present. Their relationship is with *P. taenifolium* Jenman (*P. sintenisii*), which they resemble in their rhizome scales; but they are clearly not of that species. The *Duss* specimen (no. 1654) from Martinique, mentioned above as not having been seen, is probably the unusually fertile Lesser Antilles form referred to under *P. taenifolium* and the Trinidad material is probably also of that species.

<sup>1</sup> *Hedwigia* 48: 250. pl. 12. f. 18. 1909. Invalidated by *P. gracillimum* Copel. in Perkins, *Fragm. Fl. Phil.* 189. 1905.

<sup>2</sup> *Hedwigia* 44: 100. 1905.



4. *POLYPODIUM UNDULATUM* Fourn. Mex. Pl. 1: 75. 1872.

Under this name Fournier published a description of certain plants from Mexico, Guiana, and Ecuador, these having rigid, linear, or lanceolate-linear pinnatisect fronds, 10 to 13 cm. long, 2 to 2.5 cm. broad, the segments adnate, subauriculate, gibbous, undulate, with simple veinlets. The sori are said to be 4 or 5 pairs to the segment, dorsal upon the veinlets, and borne midway between the costule and the margin. The last are characters which clearly exclude this species from the group of *P. trichomanoides* and indicate that it belongs presumably with *P. pilosissimum* and allied species.

Fournier described also a variety *parvulum*, characterized by "shorter, monosorous pinnae," and cited *P. gibbosum* Fée as a synonym, with mention of Galeotti's no. 6378 (in part). This association of a monosorous plant with *P. undulatum*, as a variety, is almost certainly erroneous and has led also to the mistaken reduction<sup>1</sup> of *P. undulatum* to *P. gibbosum*, which is itself a critical species with monosorous segments.

Type specimens of *P. undulatum* Fourn. have not been seen by the writer. If these should prove to represent a valid species it must nevertheless bear a new name, on account of Willdenow's earlier description<sup>2</sup> of a plant from Tranquebar as *Polypodium undulatum*.

**POLYPODIUM FURFURACEUM AND RELATED SPECIES.**

Perhaps no members of the genus *Polypodium*, taken in its broad sense, have received more varied and at the same time less satisfactory treatment than those species with lepidote fronds. For the accommodation of the different types more than a few genera have been proposed, as, for example, *Pleopeltis*, *Marginaria*, *Lepicystis*, and *Lopholepis* on the basis of venation, habital characters, and soriation. From the standpoint of venation alone several flexible categories might be recognized, which, with further subdivision on habital differences, would result in an excessive multiplication of genera. The faultiness of such a treatment is at once obvious from a consideration of the large number of intermediate species.

Again, it is possible to group the lepidote species under a single genus, as Diels<sup>3</sup> has done, apportioning them among several sections according to their venation. The objections to this are several: (1) It is scarcely possible to draw an obvious line of demarcation between lepidote and nonlepidote species; (2) even if such a separation were made the resulting arrangement would be altogether unnatural, necessitating the reference of very closely allied species to different genera; (3) it can not be admitted that the presence of scales upon the lamina in varying profusion is in this instance a character of generic importance. In Christensen's Index we find, for example, *Polypodium plebejum* referred to the subgenus *Marginaria*, and one of its closest allies, *P. leucosticton*, to *Eupolypodium*; *P. fallax* to *Marginaria*, and *P. typicum* to *Eupolypodium*. These are very similar in their scantily paleaceous surfaces, and their venation is

<sup>1</sup> C. Chr. Ind. Fil. 572. 1906.

<sup>2</sup> Sp. Pl. 5: 155. 1810.

<sup>3</sup> *Lepicystis*. In Engl. & Prantl, *Pflanzenfam.* 1<sup>4</sup>: 322-324. 1899.



exactly that of *Eupolypodium*. Other instances of similar confusion might be mentioned.

The inadequacy of scaly covering as a generic distinction for "Lepicystis" is shown by the complete gradation that exists, in the species with pinnatifid to pinnatisect fronds, from those with the lamina very densely covered beneath with copious imbricate scales to others in which the scales are very few and so minute as to be readily overlooked, all of these agreeing essentially in venation. This is particularly true of the *Eulepicystis* (free-veined) series. It seems to the writer quite justifiable to include *Lepicystis* in *Polypodium* and to assign its species among the commonly recognized subgenera according to venation, using the scale characters as a convenient means of grouping them within their respective subgenera and of distinguishing them from each other.

Of the free-veined lepidote species *P. furfuraceum*, *P. murorum*, and *P. plebejum* are familiar examples. These and their allies, to the number of 21 species, are treated at some length in the following pages, an effort being made to reduce the confusion which has long existed. There are, besides, brief notes upon 10 doubtful or recently described species which it is impossible to place at the present time.

#### KEY TO THE SPECIES.

Rhizome scales large, delicate, flaccid, thin, mostly pale and concolorous, thickened and dark-colored (if at all) only near their point of attachment, the cells elsewhere very thin-walled.

Lamina subpinnatisect.

Segments entire; veins diverging from the midvein at an angle of 45 to 60° ..... 1. *P. furfuraceum*.

Segments undulate, crenate, or serrate; veins diverging at an angle of 30 to 40°.

Veins usually simple, rarely forked near their apex; segments surcurrent, rounded-excavate to the midvein at the proximal side; stipe much shorter than the lamina ..... 2. *P. cryptocarpon*.

Veins invariably once forked in their basal third, the proximal branch rarely forked; segments surcurrent, not excised below; stipe as long as the lamina, or longer ..... 3. *P. platylepis*.

Lamina bipinnatifid to quadripinnatisect.

Plants relatively coarse; lamina very deeply bipinnatifid, the segments and narrowly alate secondary rachises about 1 mm. broad ..... 4. *P. lindenianum*.

Plants delicate; lamina tripinnatifid to quadripinnatisect, the rachises faintly alate; segments almost capillary, greatly exceeded by the sori ..... 5. *P. friedrichsthalianum*.



Rhizome scales smaller, more rigid, mostly bicolorous, having a dark, often sharply defined, elongate or  
 •  $\wedge$ -shaped median area of sclerotic cells.

Rhizomes about 1 mm. in diameter, extensively creeping; rhizome scales about 0.5 mm. long, bearing from their center a conspicuous erect tuft of long, brown, bristle-like hairs..... 6. *P. fallax*.

Rhizomes (except in no. 10) much stouter, up to 3 mm. thick; rhizome scales much larger, lacking hairs.

Lamina pinnately parted to pinnate, the segments or pinnae entire to pinnatifid.

Lower surface of the lamina more or less completely covered with imbricate scales, these partially concealing the sori.

Lamina long-attenuate apically, sub-pinnatisect, the segments distant, mostly joined by a very narrow wing; scales of the lamina very numerous, densely imbricate, deeply fimbriate-lacerate, the teeth very deeply bifid..... 7. *P. xantholepis*.

Lamina obtuse or acute, pinnately parted, the segments closer, joined by a broad wing; scales of the lamina fewer, less imbricate, shallowly lacerate-denticulate, the apices of the teeth entire or bipapillate.

Segments 5 to 7 pairs, unequal; rhizome scales 2.5 to 3 mm. long, the cells of the slightly darker  $\wedge$ -shaped median line with delicate darkish sclerotic partition walls, a large lumen invariably present..... 8. *P. subvestitum*.

Segments 1 to 3 pairs, subequal; rhizome scales more rigid, 1 to 1.5 mm. long, the cells of the very dark and sharply defined  $\wedge$ -shaped median line very strongly dark-sclerotic; lamina minute or obsolete..... 9. *P. fallacissimum*.

Lower surface of the lamina bearing few or numerous, mostly distant, often minute scales, these not at all concealing the sori.

Rhizome scales narrowly linear-deltoid, or long-acuminate or attenuate from a deltoid-ovate base, not sharply fuscous-carinate and not at all repand or crispate.

Scales of the lamina minute, almost linear, 4 to 7 cells broad..... 10. *P. typicum*.

Scales of the lamina much larger, rounded-ovate to deltoid.



Lamina deeply pinnatifid or sub-pinnatisect, the segments fully adnate.

Fronds 3.5 to 14 cm. long; lamina 2 to 5.5 cm. long, coriaceous.

Rhizomes wide-creeping; rhizome scales nearly entire to obtusely subdenticulate..... 11. *P. bryopodum*.

Rhizomes creeping; rhizome scales deeply and irregularly denticulate.

Scales of rhizome narrowly linear-deltoid, almost acicular..... 12. *P. pycnocarpum*.

Scales of rhizome attenuate or long-acuminate from a relatively broad deltoid-ovate base; plants smaller..... 13. *P. mollendense*.

Fronds 15 to 30 cm. long; lamina 10 to 18 cm. long, membranous-herbaceous..... 14. *P. rusbyi*.

Lamina fully pinnate, the segments sessile or subsessile, often deeply pinnatifid..... 15. *P. murorum*.

Rhizome scales roundish-ovate to broadly oblong, sharply and narrowly fuscous-carinate, the broad pale borders (except in no. 16) repand to complicate-crispate.

Fronds subdimorphous, the sterile ones short-stipitate, with a very broad lamina; fertile fronds long-stipitate, the lamina linear-oblong..... 16. *P. leucosticton*.

Fronds uniform.

Scales of the lamina minute, very few, inconspicuous... 17. *P. plebejum*.

Scales of the lamina large or, if small, at least very numerous.

Segments oblique, conspicuously crenate..... 18. *P. tweedianum*.

Segments divergent, subentire or remotely and minutely notched.

Scales of the lamina relatively large, conspicuous, castaneous, plane, broadly ovate or deltoid-ovate, long-acuminate, the margins bidentate..... 19. *P. guttatum*.



Scales of the lamina very  
 numerous, tortuous,  
 pale, linear-attenuate  
 from a small rounded  
 base, coarsely fimbri-  
 ate-dentate..... 20. *P. oulolepis*.

Lamina bipinnate, the rachises very narrowly  
 marginate..... 21. *P. monosorum*.

1. *Polypodium furfuraceum* Schlecht. & Cham. Linnaea 5: 607. 1830.

*Polypodium nivosum* Fée, Mém. Foug. 8: 89. 1857.

*Polypodium macbridense* Shimek, Bull. Lab. Nat. Hist. Univ. Iowa 4: 199. 1897.

*Polypodium margallii* Rovirosa, Pter. Mex. 206. 1910.

TYPE LOCALITY: Near Jalapa, Mexico.

DISTRIBUTION: Common from Mexico to Panama, at 200 to 1,300 meters elevation, ascending casually to 1,750 meters.

ILLUSTRATIONS: Shimek, op. cit. pl. 20. f. 6-9 (as *P. macbridense*); Rovirosa, op. cit. pl. 38A. f. 1-5 (as *P. margallii*).

Fournier, in his treatment of this species, recognizes three varieties: (1) The typical form, with which Fée's *Polypodium nivosum* is doubtless synonymous, as there stated; (2) a variety  $\beta$ , which is supposed by him to include Fée's *Polypodium cryptocarpon*; and (3) var.  $\gamma$  *coronulatum*. As to *P. cryptocarpon*, it may be said that Fée's description, though imperfect, points unmistakably to the species usually called *P. skinneri*, rather than to *P. furfuraceum*. Fournier's third form,  $\gamma$  *coronulatum*, has not been identified by the writer.

The species was next described as *P. macbridense* by Shimek upon Nicaraguan specimens, his illustration representing the ordinary form. The reference of *Polypodium margallii* to *P. furfuraceum* is also tolerably certain, the venation agreeing exactly.

There is noted in *P. furfuraceum* a great amount of variation in the color of the scales upon both the rhizome and the under side of the lamina, the extremes in color being whitish and clear yellowish brown, with numerous intermediate shades in different plants or even upon fronds of different age in the same plant. The shape of the scales also is variable. Those of the growing part of the rhizome are commonly deltoid-lanceolate, although from their being subappressed and densely imbricate they appear more or less subulate. The venation of a pinnule is shown well in Rovirosa's figure above cited.

*Polypodium furfuraceum* grows usually upon tree trunks but occasionally also upon shaded banks in well-rotted humus. The following specimens are in the U. S. National Herbarium:

MEXICO: Córdoba, Veracruz, *Bourgeau* 1439; *Orcutt* 3208; *Fink* 85½. Zacuapan, Veracruz, *Purpus* 2167. Near Jalapa, Veracruz, *Rose & Hay* 6376. Between Rosario and Colomas, in the foothills of the Sierra Madre, Sinaloa, *Rose* 1642. Orizaba, Veracruz, alt. 1,200 meters, *Seaton* 11. La Barranca, Michoacán or Guerrero, on wet rocks, *Langlassé* 317. Hills of Patzcuaro, Michoacán on oak trees, *Pringle* 3357. Between Chicoasen and San Sebastián, Chiapas, alt. 1,200 meters, *Collins & Doyle* 176. Alzada, Colima, *Orcutt* 4637.

GUATEMALA: Cubilquitz, Alta Verapaz, alt. 350 meters, *von Türckheim* (J. D. Smith, no. 7723); *von Türckheim* II. 31. Santa Rosa, Depart. Santa Rosa, alt. 900 meters, *Heyde & Lux* (J. D. Smith, no. 3252). San Juan, Utapá, Depart. Santa Rosa, alt. 1,350 meters, *Heyde & Lux*



(J. D. Smith, no. 4089 B). Fiscal, alt. 1,110 meters, on trees and limestone cliffs, *Deam* 6089, 6229. Volcán de Atitlán, Depart. Sololá, *Kellerman* 5887. Without locality, *Heyde* 212.

**COSTA RICA:** Verbena, near Alajuelita, alt. 1,000 meters, *Tonduz* 8794. Forests of Tsaki, Talamanca, alt. 200 meters, *Tonduz* 9474. Near Río de las Vueltas, Tucurrique, alt. 635 meters, *Tonduz* 12758. San Jerónimo, alt. 1,500 meters, *Wercklé* (Jiménez, no. 582). Juan Viñas, Reventazón Valley, alt. 1,000 meters, *Cook & Doyle* 298, 341. Río Turrialba, alt. 500 meters, *J. D. Smith* 6913. Turrialba, alt. 200 meters, *Pittier* 4088; *Cook & Doyle* 380. Tablazo, alt. 1,750 meters, *Brade*. Boruca, alt. 460 meters, *Tonduz* 4612. Near Santiago (east of Cartago), alt. 1,050 meters, *Maxon* 95. Vicinity of Cartago, alt. about 1,500 meters, *Maxon* 48; *Alfaro* (J. D. Smith, no. 6954). Navarro, alt. 1,050 meters, *J. D. Smith* 5098. Atirro, alt. 600 meters, *J. D. Smith* 5099. Jiménez, alt. 200 meters, *Alfaro* 155. Near San José, *Beyer* 14; *Pittier* 318; *Cook & Doyle* 12. Cerro de San Isidro, near San Ramón, alt. 1,300 meters, *Brénes* 14220, 14127. Without locality, *Wercklé*; *Cooper*.

**PANAMA:** Near El Boquete, Chiriquí, alt. 1,200 meters, *Maxon* 4960.

**2. *Polypodium cryptocarpon* Fée, Mém. Foug. 8: 88. 1857.**

*Polypodium skinneri* Hook. Sp. Fil. 4: 214. 1862.

*Polypodium bernouillii* Baker in Hook. & Baker, Syn. Fil. ed. 2. 510. 1874.

**TYPE LOCALITY:** Córdoba, Mexico (*Schaffner* 194).

**DISTRIBUTION:** Southern Mexico and Guatemala, at 300 to 1,550 meters altitude.

**ILLUSTRATIONS:** Hook. op. cit. pl. 276. B (as *P. skinneri*).

Fée's description of *P. cryptocarpon*, though incomplete, clearly applies to the species described and figured subsequently as *P. skinneri* and known usually under the latter name. Fournier listed *P. cryptocarpon* as a variety of *P. furfuraceum* and cited several collections, three of which (*Schaffner*; *Bourgeau* 1440; *Müller*) are represented in the Underwood Fern Herbarium. These agree not only among themselves but also with specimens collected by Fink at the type locality and with ample Guatemalan material, the whole representing a species remarkably distinct in venation and easily recognizable also by the lesser scaly covering of the under surface of the lamina.

Hooker's description of this species (as *P. skinneri*) is excellent, save in the one particular that "both sides" of the lamina are not "copiously clothed" with scales, the scales of the upper surface being relatively few and scattered even in young fronds. The veins are invariably free and very oblique (diverging from the midvein at an angle of 30 to 35 degrees), characters which, with the conspicuously long-paleaceous rhizome, should have sufficed to distinguish this species from the Costa Rican plants erroneously listed under this name by Dr. Christ in 1901.<sup>1</sup> These Costa Rican specimens actually pertain to *P. myriolepis* Christ, described in 1896. Further notes upon their misidentification will be found under *P. myriolepis*.<sup>2</sup> Christ finally maintains<sup>3</sup> that a single specimen of *P. skinneri* (*P. cryptocarpon*) has been collected in Costa Rica by Wercklé, but this must be regarded as very doubtful.

Baker, though the type specimens of *P. skinneri* were available to him at Kew, strangely enough redescribed this species as *P. bernouillii*, as is evident not only from his diagnosis but also from specimens of the type collection (*Bernouilli* 442) which are at hand.

<sup>1</sup> In Pittier, Prim. Fl. Costar. 3: 17.

<sup>2</sup> Page 581.

<sup>3</sup> Bull. Soc. Bot. Genève 1: 220. 1909.



The following specimens are in the U. S. National Herbarium:

GUATEMALA: Near San Felipe, Depart. Retalhuleu, alt. 600 meters, *Maxon & Hay* 3512; *J. D. Smith* 2744. Volcán de Ipalá, alt. 1,500 meters, *Pittier* 1866. Mazatanango, Depart. Retalhuleu, *Bernouilli* 442 (type collection of *P. bernouillii*). San Andrés Osuna, Depart. Escuintla, *C. & E. Seler* 2582. Without exact locality, *Watson*; *Mrs. W. P. Cock-erell*.

MEXICO: District of Córdoba, Veracruz, *Fink* 81, 85½ (in part). Finca Mexiquito, Chiapas, *Purpus* 6752.

### 3. *Polypodium platylepis* Mett.; Kuhn, *Linnaea* 36: 137. 1869.

TYPE LOCALITY: Guatemala.

DISTRIBUTION: Guatemala (and southern Mexico?), at an altitude of 2,400 to 2,500 meters. Ascribed also to "New Granada," probably in error.

The present species was described from material said to have been collected in "New Granada" by Linden and in Guatemala by Skinner. Hieronymus states<sup>1</sup> that he has not seen the original specimens, although these should presumably be in the Mettenius herbarium at Berlin; nor was Professor Underwood able to find them there. There is, in any case, good reason for doubting that Colombia is the source of Linden's plant, since, as pointed out on page 564, several interchanges of locality data are known to have been made for plants collected by him in Mexico, Colombia, and Cuba, and since this species has subsequently been found chiefly, if not altogether, in Guatemala. Linden's specimen almost certainly came from the mountains of southern Mexico. In fact, there is at Kew, according to Dr. Underwood's notes, a specimen of this species, collected at Mirador, Veracruz, by Linden in 1838. This may be a duplicate of that studied by Mettenius and Kuhn. Nevertheless, in view of the uncertainty, it is probably better to take as the type Skinner's plant, concerning the source of which there is no doubt. There is also a duplicate of this at Kew.

*Polypodium platylepis* is readily recognized by its serrate-tipped pinnæ and by its disproportionately long, slender, shaggy stipes.

The following specimens are in the U. S. National Herbarium:

GUATEMALA: Humid forest belt of the Volcán de Agua and in the "Altos" above Solalá, alt. about 2,500 meters, May 31, 1882, *Lehmann* 1484. Above Antigua, alt. 2,400 meters, February 18, 1905, *Kellerman* 4877.

### 4. *Polypodium lindenianum* Kunze, *Farrnkr.* 2: 83. 1851.

*Polypodium cancellatum* Fée, *Gen. Fil.* 242. 1852; *Mém. Foug.* 6: 12. 1853.

*Polypodium verapax* Christ, *Bull. Herb. Boiss.* II. 5: 253. 1905.

TYPE LOCALITY: San Bartolo, Chiapas, Mexico.

DISTRIBUTION: Southern Mexico and Guatemala, ascending to 2,100 meters.

ILLUSTRATIONS: Kunze, *op. cit.* *pl.* 134; Fée, *Mém. Foug.* 6: *pl.* 7. *f.* 2 (as *P. cancellatum*).

The type of the present species was collected by Linden, three separate localities being mentioned by Kunze—San Bartolo, Yerbabuena, and the Province of Chiapas. There are several towns in Mexico called San Bartolo, the one here meant being doubtless the small place of that name (not shown on most maps) about 35 miles due north of Tuxtla, Chiapas. Yerbabuena also is in Chiapas, about 60 miles in a general easterly direction from Tuxtla. Linden's third locality, mentioned by Kunze as the "Provinz Chiapas," was doubtless near by. The last is said to be at about 7,000 feet altitude, the highest elevation known for this species. Munch has recently re-collected it in this general region.<sup>2</sup>

<sup>1</sup> *Bot. Jahrb. Engler* 34: 531. 1905.

<sup>2</sup> Christ in *Bull. Herb. Boiss.* II. 5: 253. 1905; 5: 730. 1905.



*Polypodium cancellatum* Fée is precisely *P. lindenianum* Kunze. It was founded upon specimens said to have been collected in Cuba by Linden. Kuhn long ago correctly pointed out<sup>1</sup> that, no other collector having found this species in Cuba and Linden having collected not only in Cuba, but also in Venezuela and in Mexico, the locality "Cuba" was probably erroneous.

*Polypodium verapax* Christ was described upon three collections from eastern Guatemala, one of which (*von Türckheim* 7726) is at hand. This is apparently a young state of *P. lindenianum*, differing in no respect from other immature examples of this species.

Kunze's figure, and more particularly Fée's, will convey an excellent idea of this species. It is most nearly related to *P. friedrichsthalianum*.

The following collections, represented by many specimens, are in the U. S. National Herbarium:

GUATEMALA: Cobán, Alta Verapaz, alt. 1,350 meters, *von Türckheim* (J. D. Smith, no. 1); *Salvin.* Senahú, Alta Verapaz, *Maxon & Hay* 3304. Cubilquitz, Alta Verapaz, alt. 105 meters, *von Türckheim* (J. D. Smith, no. 7726).

MEXICO: Cerro del Boquerón, Chiapas, *Purpus* 7227.

**5. *Polypodium friedrichsthalianum* Kunze, *Farrnkr.* 2: 55. 1850.**

TYPE LOCALITY: Guatemala ? (*Friedrichsthal* 1322).

DISTRIBUTION: Mountains of Costa Rica, altitude 810 to 1,550 meters. Also in Guatemala (?).

ILLUSTRATIONS: Kunze, op. cit. *pl.* 123; Mett. *Abh. Senckenb. Ges. Frankfurt* 2: *pl.* 1. *f.* 17.

The precise locality for Friedrichsthal's plant was unknown to Kunze, and it is quite likely that in this instance as in others (for example, that of *Hemitelia nigricans* Presl),<sup>2</sup> the type specimen, though credited to Guatemala, did not actually come from the present limits of that country. At any rate *P. friedrichsthalianum* has not been rediscovered there during the rather extensive botanical exploration of recent years. Christensen assigns to it the range "Mexico-Costa Rica"; but it is probable that it does not occur in Mexico, its reported occurrence there being due to its confusion with *P. lindenianum*. It is known at present chiefly, if not wholly, from Costa Rica, where, according to the writer's observations and several records by Christ,<sup>3</sup> it is common at middle elevations in the interior mountain region, growing as commonly perhaps upon old stone walls as upon tree trunks. As Christ has remarked, its segments are almost filiform and are greatly exceeded by the large sori. Kunze's figure well represents a plant of medium size except as to rhizome scales, which should be like those of *P. lindenianum*.

The following collections, representing a large series of specimens, are in the U. S. National Herbarium:

COSTA RICA: Alto de Ochmogo, alt. 1,550 meters, *Tonduz* 10391. San Isidro, alt. 1,100 meters, *Alfaro* 105. Cerro de San Isidro, near San Ramón, alt. 1,200 to 1,300 meters, *Brénes* 14222. Alajuela, alt. 810 meters, *Cooper* (J. D. Smith, no. 6051). Vicinity of Cartago, alt. 1,300 to 1,500 meters, *Beyer* 19; *Maxon* 26; *J. D. Smith* 5100, 6962. Santiago, near San Ramón, alt. 1,100 meters, *Brénes* 14241; *Tonduz* 17574. El Rosario de Rosí, alt. 1,120 meters, *Pittier* 16624. Río Virilla, *Biolley*. Without exact locality, *Wercklé*; *Cooper*.

<sup>1</sup> *Abh. Naturf. Ges. Halle* 11: 21. 1869.

<sup>2</sup> *Bull. Torrey Club* 38: 547. 1911.

<sup>3</sup> In *Pittier*, *Prim. Fl. Costar.* 3: 13. 1901; *Bull. Herb. Boiss.* II. 5: 253. 1905.



**6. *Polypodium fallax* Schlecht. & Cham. Linnaea 5: 609. 1830.***Micropteris fallax* J. Smith, Hist. Fil. 186. 1875.*Lepicystis fallax* Diels in Engl. & Prantl, Pflanzenfam. 1<sup>4</sup>: 323. 1899.*Polypodium margaritiferum* Christ, Bull. Herb. Boiss. II. 5: 3. 1905.

TYPE LOCALITY: Region of Misantla, Mexico.

DISTRIBUTION: Mexico to Costa Rica, from sea level to at least 1,300 meters altitude.

ILLUSTRATIONS: Christ, op. cit. *text fig.* (as *P. margaritiferum*); Abh. Senckenb. Ges. Frankfurt 2: *pl. 1. f. 4-6*; Fée, Gen. Fil. *pl. 10. A. f. 2*.

The characters of *Polypodium fallax* are well known and need not here be repeated. The form described and figured by Christ as *P. margaritiferum* is merely an extreme one and is directly connected with typical *P. fallax* by specimens collected at the type locality of *P. margaritiferum* but not included in that by Christ (viz, *Tonduz* 10083).<sup>1</sup>

*Polypodium fallax* is the type species of John Smith's ill-founded genus *Micropteris*. The presence of a few scattered scales upon the lamina is not in any sense a generic character, and the long-scandent rhizome and small fronds characterize a type of plant which has its counterpart in most of the large genera of ferns, as, for example, in *Asplenium*, in the instance of *A. fliccaule* Baker.

Fournier cites many Mexican localities for *P. fallax*, omitting altitudes, however. Diels mistakenly refers to it as a Central American species occupying an altitudinal range of from 1,000 to 2,000 meters. The writer has collected it at sea level in Guatemala and has no record of its occurrence above 1,300 meters. It is invariably epiphytic, creeping widely upon trees and shrubs.

The following specimens are in the U. S. National Herbarium:

MEXICO: Tlapacoyo, *Liebmann*. District of Córdoba, Veracruz, *Fink* 68; *Orcutt* 3216. Zacuapan, Veracruz, *Purpus* 4369. Near Orizaba, alt. about 1,300 meters, *Pringle* 6124; *Bourgeau* 2784. San Cristobal, near Orizaba, *Mohr*. Without locality, *Schaffner* 27.

GUATEMALA: Cubilquitz, Alta Verzapaz, alt. 350 meters, *von Türckheim* II. 85. Livingston, near sea level, *Maxon & Hay* 3782. Choctum, *Salvin*.

HONDURAS: Trail near Río Plátano, *Wilson* 685.

COSTA RICA: Santo Domingo de Golfo Dulce, at sea level, *Tonduz* 11257 (type of *P. margaritiferum*); *Tonduz* 10083 (J. D. Smith, no. 7252).

**7. *Polypodium xantholepis* Harrington, Journ. Linn. Soc. Bot. 16: 36. 1877.**

TYPE LOCALITY: Oroya, between San Bartolomeo and San Mateo, Peru (*Steere*).

DISTRIBUTION: Mountains of Peru.

*Polypodium xantholepis*, of which among other material two fronds of the original collection are at hand, was both inappropriately named and inadequately described by Harrington. It is, moreover, not "very near *P. incanum*," as was suggested, but related rather to *P. subvestitum* and *P. fallacissimum*. It differs from all the species of this group in the exceedingly dense and widely imbricate scaly covering of the under surface of the lamina. The scales of the rhizome are 2 to 2.8 mm. long, abruptly lance-attenuate from a much broader base, attached at the yellowish center above the base, the surrounding cells strongly sclerotic, a dark median band of similar but more elongate, thick-walled cells extending nearly to the flexuous, attenuate apex; the margins of the scales are pale or whitish and composed of several rows of short to transversely oblong, mainly thin-walled cells, the outermost row arranged as a shallowly fimbriate-denticulate border, the teeth bifid. The bright brown scales

<sup>1</sup> This number is elsewhere cited by Christ (Bull. Herb. Boiss. II. 3: 13. 1901.) as *P. fallax*.



of the under surface are described briefly in the key. The rachis is strongly elevated beneath and is black or blackish, not (as in *P. subvestitum* and *P. fallacissimum*) more or less completely immersed in the pagina and evident only as a low ridge.

Aside from the very pronounced paleaceous under surface the most conspicuous gross character lies in the slender, long-attenuate apex of the fronds, the terminal segment being greatly elongate, 4 to 6 times as long as the next lowest segments. This alone will distinguish this species from its two nearest allies, though its dense scaly covering beneath, the raised blackish rachis, and the relatively slender rhizome scales are hardly less characteristic.

The following specimens are in the U. S. National Herbarium:

PERU: Two fronds of the type collection, *Steere*. Andes, *Wilkes Exped.* (as *Goniophlebium tweedianum*). Mountains back of Lima, along the Oroya Railway, *Safford* 998.

**8. *Polypodium subvestitum* Maxon, sp. nov.**

Rhizomes rather short-creeping, 2 to 4 (rarely 10) cm. long, branched, 2 to 3 mm. in diameter, freely radicose, conspicuously paleaceous, the scales appressed, closely imbricate, 2.5 to 3 mm. long, broadly deltoid-ovate, thin, attached above their rounded base, brownish in mass, thin, translucent, with a poorly defined, median,  $\Lambda$ -shaped zone of slightly darker cells (these with dark brown sclerotic partition walls and large lumina), the margins composed of pale thin-walled cells, the outermost row of these transversely linear, forming an irregularly denticulate border, the teeth mostly bipapillate at their tip. Fronds erect, subfasciculate, 8 to 16 cm. long, the stipe usually much longer than the lamina; stipes 3.5 to 10 cm. long, about 1 mm. thick, stramineous, faintly marginate toward the apex, deeply bisulcate on the anterior face, deciduously paleaceous; lamina deltoid-oblong, 3.5 to 7 cm. long, 2 to 4 cm. broad at the base, pinnately parted, with 5 to 7 pairs of oblique linear-oblong acutish dilatate segments, these unequal, the basal ones subdistant, 1 to 2.3 cm. long, sometimes with an oblique lobe (2 to 6 mm. long) upon the proximal side, the middle ones closer and slightly shorter, the apical ones gradually much shorter and finally evident as triangular lobes below the acute or abruptly short-caudate apex; margins subentire to distantly repand-serrulate or, in the largest segments, coarsely crenate; rachis and midveins partially concealed, their course evident; veins free, wholly concealed, 6 to 8 pairs, spreading, subdistant, mostly twice forked, the branches short; sori 5 to 8 pairs, large, nearly equidistant, terminal upon the first branch of the veins. Leaf tissue herbaceo-coriaceous, yellowish green, glabrous above, partially covered with scales beneath, these subpersistent, 1.5 to 2 mm. long, orbicular-ovate to deltoid-ovate, acuminate, light brown in mass, appressed, subimbricate, the cells mostly short and subhexagonal (the partition walls somewhat sclerotic but pale), the outermost row transversely elongate, forming an irregular denticulate border, the teeth bipapillate at their extremity.

Type in the U. S. National Herbarium, no. 833209, collected in the vicinity of La Paz, Bolivia, altitude about 3,000 meters, in 1889, by Miguel Bang (no. 122); distributed as *Polypodium macrocarpum* Presl.

The following additional specimens are in the U. S. National Herbarium:

BOLIVIA: A second sheet of the type collection, *Bang* 122. Near La Paz, alt. 3,000 meters, April, 1885, *Rusby* 365 (2 sheets). Without precise locality, *Bang* 2598 (2 sheets).

This species is closely related only to *P. fallacissimum*, from which it may be separated by the characters mentioned in the key and under the description of that species, next following.



**9. *Polypodium fallacissimum* Maxon, sp. nov.**

Rhizomes short-creeping, sparingly branched, the branches 1 to 3 cm. long, about 1.5 mm. thick, woody, the older portions with numerous short rounded phyllopodia (1 to 3 mm. apart), the growing portion conspicuously paleaceous, the scales subappressed, imbricate, rigid, 1 to 1.5 mm. long, deltoid-ovate, long-acuminate, attached above their base, with a sharply defined black median line of strongly sclerotic cells extending from the apex to each side of the point of attachment (thus narrowly  $\Lambda$ -shaped), the margins composed of pale translucent cells, the outermost row transversely linear, arranged as an irregular papillate-denticulate border. Fronds erect or ascending, closely distichous (appearing subfasciculate), simple or pinnately parted, the smaller simple ones often fertile, 2 to 3 cm. long, subspatulate, the lamina 1 to 1.5 cm. long, rounded-oblongate (the short stipe narrowly marginate), with 6 to 9 pairs of very oblique 1 to 3-forked veins, the sori medial, terminal upon the proximal branches; characteristic pinnately parted fronds 3 to 13 cm. long; stipe 1.5 to 7 cm. long, slender, stramineous, greenish-marginate or at the apex distinctly alate, deciduously paleaceous; lamina 2 to 6 cm. long, 1.3 to 2 cm. broad, variable in shape, with 1 to 3 pairs of oblique, subdistant, oblong to linear-oblong, rounded or sharply acute, subentire to serrulate lateral segments and a similar or larger and elongate terminal segment, these connected by a conspicuous costal wing about 2 mm. broad upon each side of the low, partially concealed, olivaceous costa; veins close, slender, concealed, very oblique, about 7 pairs in the larger segments, free or very rarely subgoniophleboid, once or twice forked, the large sori (5 or 6 pairs) terminal upon the first (proximal) branches, medial, impressed. Leaf tissue rigidly coriaceous, bright or yellowish green, smooth above, beneath rather densely paleaceous, the scales mostly persistent, 1.5 to 1.8 mm. long, oblong-ovate or mostly ovate-deltoid, brownish castaneous in mass, subappressed, imbricate, nearly homogeneous, the cells mostly short and subhexagonal (the partition walls somewhat sclerotic but yellowish brown, not fuscous), the outer 1 or 2 rows quadrate or transversely oblong, forming an irregular denticulate border, the teeth entire.

Type in the U. S. National Herbarium, no. 471295, collected at San Lorenzo Canyon, 6 miles southeast of Saltillo, State of Coahuila, Mexico, September 21 to 23, 1904, by Dr. Edward Palmer (no. 426). The small, simple-fronded state of this species is represented also by Doctor Palmer's no. 425, collected at the same time and place.

*Polypodium fallacissimum*, though related to *P. subvestitum*, is readily recognized as distinct by the key characters. The scales of the under surface are brighter colored and rather narrower than those of *P. subvestitum*, their margins also less deeply denticulate, the teeth entire rather than bipapillate. The last character immediately separates both *P. fallacissimum* and *P. subvestitum* from *P. xantholepis*, a species with more slender, deeply lacerate-fimbriate lamina scales, their teeth very deeply bifid.

As mentioned under *P. pycnocarpum*, Fournier reported as *P. macrocarpum* two collections from Jalapa, Mexico, which probably pertain to *P. fallacissimum*. Fée also described, as *Heteroneuron paradoxum*,<sup>1</sup> a plant collected by Galeotti which is either *P. fallacissimum* or a very closely related form. That it is probably not identical with *P. fallacissimum* may be inferred from the regular goniophleboid venation shown in Fée's figure, but it is strikingly similar in habit and general appearance. Fournier<sup>2</sup> clearly is wrong in citing it as a

<sup>1</sup> Mém. Foug. 6: 3. pl. 1. f. 4. 1853.

<sup>2</sup> Mex. Pl. Crypt. 84. 1872.



synonym of *P. thyssanolepis* A. Br., a point noted by Christensen.<sup>1</sup> The name *paradoxum* would in any event be unavailable for the Mexican plant in the genus *Polypodium*, because of *Polypodium paradoxum* Colenso, a New Zealand species described in 1882.

**10. *Polypodium typicum* Fée, Crypt. Vasc. Brés. 2: 52. 1872-73.**

TYPE LOCALITY: Itatiaia, Brazil (*Glaziou* 5294).

DISTRIBUTION: Brazil.

ILLUSTRATION: Fée, op. cit. *pl.* 96. *f.* 2; Lindm. Ark. för Bot. 1: *pl.* 11. *f.* 8.

This species, which is perhaps not very common, was well illustrated by Fée. The scales of the under side are few, minute, scattered, linear or very narrowly lance-deltoid, only a few cells broad, pale yellowish brown, and retrorsely and irregularly erose-denticulate. The rhizome scales are about 2 mm. long, lance-deltoid, pale yellowish brown in mass (individual scales appearing lighter), and mostly with a pronounced median stripe of opaque dark brown cells, the marginal part being whitish, irregularly lacerate, and composed of pale translucent cells. The scales of both the rhizome and the lamina are very different in shape and structure from those of *P. pycnocarpum* and several related species, to all of which *P. typicum* bears little more than a slight superficial resemblance.

The following specimens are in the U. S. National Herbarium:

BRAZIL: Lages, Santa Catharina, *Spannagel* (Rosenstock, no. 200). Alto do Serra, São Paulo, *Wacket* (Rosenstock, no. 347). Terromecco, Rio Grande do Sul, *Kunert* 7.

**11. *Polypodium bryopodum* Maxon, sp. nov.**

Rhizome slender, firm, and wide-creeping, 5 to 10 cm. long and more, 1.5 to 2 mm. in diameter, with a few short branches, conspicuously paleaceous, the scales imbricate, subappressed (their long, slender tips divaricate-secund), rather lax, 2.5 to 3 cm. long, long-acuminate or attenuate from a deltoid-ovate rounded base, dark brown in mass, nearly homogeneous, not bicolorous, composed of short to mostly elongate, distinctly luminate, polyhedral cells with dark reddish brown sclerotic partition walls, the outer cells smaller, paler, oblique to transverse, the margins obtusely subdenticulate, or sharply denticulate at the attenuate apices. Fronds erect, 0.5 to 4 cm. apart, 3.5 to 10 cm. long, the stipe usually longer than the lamina; stipe 2.5 to 7 cm. long, 0.5 to 1 mm. thick, stramineous, sparingly and deciduously paleaceous; lamina deltoid to deltoid-oblong, 2 to 4 cm. long, 1 to 2.2 cm. broad at the base, obliquely pinnatifid nearly to the concealed or partially evident rachis; segments 3 to 6 pairs, unequal, the basal ones the largest, 7 to 13 mm. long, 3 to 4 mm. broad, linear-oblong, obtuse, slightly decurrent; upper segments gradually shorter, finally evident as lobes of the short-acuminate apex; margins slightly cartilaginous, distinctly but shallowly crenate, the crenations 1.5 to 2.5 mm. long, nearly straight; midveins concealed; veins 4 to 6 pairs in the larger segments, oblique, once or twice forked, mostly free; sori 3 to 5 pairs, medial or subterminal upon the proximal branches, large, contiguous, nearly covering the segments; sporangia glabrous, the annulus usually 16-celled; spores diplanate, granulose. Leaf tissue yellowish green, coriaceous, glabrous above, beneath distantly paleaceous, the scales persistent, appressed, dark brown, 0.8 to 1.5 mm. long, deltoid-ovate, acuminate to attenuate, subentire to obtusely erose-dentate, nearly homogeneous; cells widely luminate, the middle ones short, polygonal, with brown, strongly sclerotic partition walls, the outer ones transverse and paler.

<sup>1</sup> Ind. Fil. 351. 1905.



Type in the U. S. National Herbarium, no. 464148, collected on moist mountain slopes near La Paz, Bolivia, altitude about 3,900 meters, March 18, 1906, by Dr. O. Buchtien (C. Baenitz, Herbarium Americanum, no. 1451); this number is also well represented in the Gray Herbarium. A second collection of the same species is at hand from Pelichuco, Bolivia, altitude 3,300 meters, *R. S. Williams* 2637.

As noted under *P. pycnocarpum*, the present species is the one mistakenly described by Kunze,<sup>1</sup> upon Peruvian specimens collected by Cuming (no. 940), as *P. macrocarpum*. From *P. pycnocarpum*, which is perhaps its nearest ally, *P. bryopodium* differs materially in its lesser size, wide-creeping rhizomes, and more delicate, distant fronds, as well as in characters afforded by the scales of the rhizome and the under surface of the lamina. The two species are similar in having very narrow, subsecund rhizome scales, a feature which wholly excludes from comparison such plants as the Mexican *P. fallacissimum* and the Bolivian *P. subvestitum*, both here described as new. In the rhizome scales of none of these four species is there the sharp, strongly defined, blackish median stripe which, with the wide, pale, repand border of thin-walled cells, unmistakably characterizes the subgroup of *P. plebejum* and its several allies.

**12. *Polypodium pycnocarpum* C. Chr. Ind. Fil. 326. 1905.**

*Polypodium macrocarpum* Presl, Rel. Haenk. 1: 23. 1825, not Bory, 1810.

TYPE LOCALITY: Mountains of Peru (*Haenke*).

DISTRIBUTION: Mountains of Peru, altitude 3,700 meters.

ILLUSTRATION: Presl, op. cit. pl. 1. f. 4 (as *P. macrocarpum*).

This species as variously misunderstood in the past has included plants from a large part of continental America which pertain to several additional and entirely distinct species; for example, *P. subvestitum*, *P. fallacissimum*, *P. tweedianum*, and *P. bryopodium*. The affinities of these are indicated in the preceding key. True *P. pycnocarpum* is evidently very rare. The name *pycnocarpum* is merely a change made necessary by the circumstance that *P. macrocarpum* Presl is a homonym.

The rather crude original illustration of this species by Presl was republished by Kunze in 1840<sup>2</sup> in comparison with smaller Peruvian specimens (*Cuming* 940)<sup>3</sup> which were assumed to be of the same species and which formed the principal basis of a new description of supposed *P. macrocarpum*, as it was then called. That the figures of Haenke's and Cuming's specimens represent two species is now evident from excellent Peruvian specimens lately received (*Rose* 19467), which agree very closely with Presl's description and figure. The Cuming plants described and figured by Kunze are *P. bryopodium*, a new species here described.

On the basis of Presl's original description and illustration, but chiefly the Peruvian specimens of Dr. Rose's recent collecting, *P. pycnocarpum* may be characterized as follows:

Rhizome creeping, sparingly branched, 2 to 5 cm. long, 1.5 to 2 mm. in diameter, freely radicle beneath, densely paleaceous, the scales imbricate, irregularly subsecund, about 3 mm. long, narrowly linear-deltoid (0.6 to 0.76 mm. broad at the base), long-attenuate, dark brown in mass, somewhat bicolorous by transmitted light, the dark median area composed of mostly linear-oblong, elongate-lunate cells with blackish sclerotic partition walls; marginal zone consisting of 2 or 3 rows of thin-walled whitish cells, the outermost trans-

<sup>1</sup> Farrnkr. 1:25. pl. 13. f. 2a, c-g. 1840.

<sup>2</sup> Op. cit. 1: pl. 13. f. 2b.

<sup>3</sup> Op. cit. 1: pl. 13. f. 2a. c-g.



verse, arranged as a deeply and irregularly denticulate border, the teeth bifid. Fronds several, 3 to 6 mm. apart, 7 to 14 cm. long; stipe 4 to 9 cm. long, 0.5 to 0.7 mm. in diameter, light brownish from a darker base, conspicuously bisulcate anteriorly; lamina deltoid to ovate-deltoid, acuminate, 3.5 to 5 cm. long, 2.5 to 4 cm. broad at the base, pinnatifid to within 1.5 mm. of the elevated, usually greenish rachis; segments 5 to 7 pairs, spreading nearly at a right angle, very narrowly oblong, the lowermost the largest, 1.8 to 2.2 cm. long, 4 to 5 mm. broad, the upper ones gradually shorter; margins faintly crenate, the crenations 2 to 3 mm. long, straight; midveins wholly concealed; veins 7 to 10 pairs, once or mostly twice forked, the sori terminal upon the first branch; sori 6 to 9 pairs, large, medial, very prominent; sporangia glabrous, the annulus usually 14-celled; spores diplanate, yellowish, granulose. Leaf tissue elastico-coriaceous, the segments often tortuous and somewhat involute in drying; lower surface distantly but distinctly paleaceous, the scales minute, ovate to narrowly ovate-deltoid, long-acuminate to attenuate, 8 to 1.5 mm. long, 0.4 to 0.6 mm. broad, brown with paler margins, denticulate.

As already noted, *P. pycnocarpum* has been very generally misidentified and its concept widely extended. Thus, Christensen, in his Index Filicum, gives the range "Mexico-Chile-Argentina" for this species. The citation of Mexico is presumably taken from Fournier,<sup>1</sup> who mentions two collections by de Buren and Hahn, from the mountains near Jalapa. These plants, which have not been examined, are probably referable to *P. fallacissimum*, a very distinct species which is related rather to *P. subvestitum*.

Also, Diels<sup>2</sup> has published, as *Lepicystis macrocarpa* (Presl) Diels, a figure which very evidently is redrawn from the original illustration of *P. tweedianum* Hook., a species which is extremely different in characters offered by the scales, particularly of the rhizome. Notes on *P. tweedianum* are given elsewhere.<sup>3</sup>

Further material in this group is greatly needed. The single specimen of *P. pycnocarpum* mentioned above is from the vicinity of Oroya, Peru, altitude 3,700 meters, Rose 19467.

**13. *Polypodium mollendense* Maxon, Smiths. Misc. Coll. 65<sup>3</sup>: 1. 1915.**

TYPE LOCALITY: Low hills near Mollendo, Peru.

DISTRIBUTION: Known only from the type locality.

This recently described species is a close ally of *P. pycnocarpum* and *P. bryopodium*, with which it is contrasted elsewhere. Unlike most of the species of this group it is a plant of low altitudes and occurs, so far as now known, only near the coast. The following collections have been studied:

PERU: Low hills near Mollendo, Williams 2978 (type); Rose 18989.

**14. *Polypodium rusbyi* Maxon, sp. nov.**

Rhizome wide-creeping, 10 to 20 cm. long, flattish, rather slender (1 to 2 mm. in diameter), deciduously paleaceous, the scales slender, closely appressed, imbricate, narrowly deltoid-lanceolate, long-attenuate, 3 to 4 mm. long, yellowish brown, the median portion darker, consisting of narrow cells with reddish brown sclerotic partition walls and with mostly distinct lumina, the borders equally broad, not very sharply defined, consisting mainly of translucent, oblique or transversely linear, minute, thin-walled cells, the margin of the scale irregularly erose-denticulate. Fronds few, 1 to 3 cm. apart, 15 to 30 cm. long, borne upon short broad paleaceous phyllopodia; stipe 5.5 to 17 cm. long, 0.6 to 0.9 mm. thick, stramineous to pale brownish, convex upon the posterior side, bisulcate

<sup>1</sup> Mex. Pl. Crypt. 83. 1872.

<sup>2</sup> Engl. & Prantl, Pflanzenfam. 14: 322. f. 167. C. 1899.

<sup>3</sup> Page 574.



upon the anterior side, narrowly marginate at the apex; lamina 10 to 18 cm. long, 5 to 8 cm. broad at the base, narrowly deltoid, subpinnatisect throughout, the pinnæ successively shorter toward the conspicuously long-caudate apex (this 2 to 4 cm. long, 3 to 7 mm. broad), the yellowish rachis narrowly foliaceous-marginate in the lower part, more broadly so toward the apex; segments 10 to 12 pairs, horizontal (or the lower ones deflexed), 1 to 3 times their width apart, mostly linear, the basal ones 2 to 4 cm. long, 4 to 7 mm. broad, acutish, surcurrent, excavate nearly to the midvein upon the proximal side; middle segments similar but slightly shorter, subequally dilatate and joined by a narrow wing; apical segments about 1 cm. long, or less; margins slightly cartilaginous, slightly undulate, distantly appressed-serrulate; veins 8 to 13 pairs, partially concealed, mostly twice forked, the large sorus usually terminal upon the proximal branch; sori 7 to 12 pairs, nearly medial. Leaf tissue grayish green, membranaceous, glabrous and nonpaleaceous above, beneath bearing numerous scattered scales, these small but easily visible to the naked eye, 1 to 1.5 mm. long, narrowly deltoid, sometimes long-acuminate, attached above the rounded base, brownish, darker in the median part (the cells rather short, quadrate or polyhedral, with reddish brown sclerotic partition walls and large lumina), the paler borders composed of 1 or 2 rows of transversely oblong thin-walled cells, the margin rather conspicuously erose-denticulate.

Type in the U. S. National Herbarium, no. 50934, collected in the vicinity of Yungas, Bolivia, altitude about 1,800 meters, 1885, by H. H. Rusby (no. 353); distributed as *Polypodium plebejum* Schlecht. & Cham.

The following additional material, all in the National Herbarium, has been studied:

BOLIVIA: A second sheet of the type collection, *Rusby*-353. Soratá, alt. 3,000 meters, February, 1886, *Rusby* 352 (2 sheets). Without precise locality, *Bang* 2592.

The rhizome scales of *P. rusbyi* are slender, closely appressed, and neither crispate nor fuscous-carinate, and so indicate very clearly that this species is not a near relative of *P. plebejum*. They do, however, suggest a relationship with *P. typicum* and *P. murorum*. With the first of these *P. rusbyi* is not likely to be confused, on account of the much greater size of all its parts. From the latter it is easily distinguished by its fully adnate segments, more delicate texture, and the fewer, smaller, paler, and more distant scales of the under surface.

As mentioned on page 575, this plant, as represented by Rusby's 352 and 353, is included by Hieronymus under *P. tweedianum*, a disposition which to the writer seems certainly erroneous.

**15. *Polypodium murorum* Hook. Icon. Pl. 1: pl. 70. 1837.**

*Polypodium sporadolepis* var.  $\beta$  Mett. Abh. Senckenb. Ges. Frankfurt 2: 67. 1856.

TYPE LOCALITY: Vicinity of Quito, Ecuador (*Jameson* 49).

DISTRIBUTION: Costa Rica, Colombia, and Ecuador, ascending to 3,400 meters.

ILLUSTRATION: Hook. op. cit. pl. 70.

Available material of this species is not complete enough to admit of more than temporary treatment. Jameson's original specimens, which are exceedingly fertile and appear to have grown in the open, are matched by several plants of his collecting in the National Herbarium. They represent an extreme form which is deeply bipinnatifid. Most other Ecuador specimens at hand have the pinnæ subentire, an apparently intermediate state being Rosenstock's no. 1a. There is great variation also in the scaly covering of the under side, the congested plants of Jameson having a dense imbricate covering, while larger and



partially sterile fronds of other collections are less scaly. The scales of the under side in all the fronds, however, are distinctive.

*Polypodium murorum* is known from North America only upon Mr. Pittier's single collection from an isolated and little explored part of Costa Rica, this having been reported upon by Christ<sup>1</sup> in 1901.

The following specimens are in the U. S. National Herbarium:

COSTA RICA: El Páramo de Buena Vista, alt. 3,000 meters, *Pittier* 10485.

ECUADOR: Without locality, *Jameson*; *Couthouy*. Cubillin, eastern Cordillera, alt. 2,400 meters, *Rimbach* (Rosenstock, no. 1a.). Rio Suguibí, western Cordillera, alt. 3,200 meters, *Rimbach* (Rosenstock, no. 34). Near Quito, alt. 2,800 to 3,300 meters, *Lehmann* 157. Near Yerbás Buenas, western Cordillera, alt. 2,600 to 3,300 meters, *Lehmann* 5726.

16. *Polypodium leucosticton* Kunze, *Linnaea* 20: 380. 1847.

*Polypodium karwinskyanum* A.Br.; Mett. Abh. Senckenb. Ges. Frankfurt 2: 66. 1856, in part.

*Polypodium plebejum* var. *columbiense* Kuhn, Abh. Naturf. Ges. Halle 11: 40. 1869.

*Polypodium plebejum* var. *palmense* Christ, Bull. Herb. Boiss. II. 5: 4. 1905.

TYPE LOCALITY: Colombia.

DISTRIBUTION: Mountains of Central America and northern South America, ascending to 2,300 meters.

The present species, which was founded upon two separate collections from Colombia (*Hartweg* 1499 and *Moritz* 336), has been discussed recently at some length by Hieronymus,<sup>2</sup> who appears to have somewhat enlarged its scope. In the absence of authentic specimens of the original collections the present writer can add little to Hieronymus's treatment and will merely suggest that there are here included several forms which probably are specifically distinct. In order to distinguish these properly it will doubtless be necessary to assemble a large series of ample and well prepared specimens, which have been carefully selected in the field. Abraded, discolored, and incomplete material in this species is nearly worthless, because of the partial dimorphism of the fronds and the need of a full knowledge of the scale characters. Thus, partly upon this account, Hieronymus has been led into the error of citing Lehmann's no. 640, from southern Colombia, as belonging to this species, whereas in its densely paleaceous under surface it is clearly distinct and possibly represents an undescribed but closely related species.

Christ<sup>3</sup> also has discussed the characters of *P. leucosticton* in referring to it his own *P. plebejum* var. *palmense*, founded upon two Costa Rican specimens (*Tonduz* 12571; *Pittier* 13257), and has cited additional Central American material.

Kuhn's *P. plebejum* var. *columbiense* is the exact equivalent of *P. leucosticton*, the name *columbiense* having been given merely as a new designation for *leucosticton*, when this form was reduced to varietal rank under *P. plebejum*, as Kuhn thought proper.

Regarding *P. leucosticton* in the broad sense of Hieronymus and Christ, it may be distinguished from *P. plebejum* not only by its plane or somewhat undulate (not crispate) rhizome scales, but also by its stouter and more or less alate stipes and usually by its subdimorphous fronds; that is, the sterile fronds are short-stipitate, the lamina commonly deltoid-oblong and relatively

<sup>1</sup> In Pittier, Prim. Fl. Costar. 3: 14. 1901.

<sup>2</sup> Bot Jahrb. Engler 34: 521. 1905.

<sup>3</sup> Bull. Soc. Bot. Genève II. 1: 219. 1909.



very broad, and the fertile fronds long-stipitate, the lamina linear-oblong and nearly or quite pinnatisect, the pinnules often distant.

The following specimens in the U. S. National Herbarium are grouped tentatively under *P. leucosticton*:

GUATEMALA: Pansamalá, Dept. Alta Verapaz, alt. 1,150 meters, *von Türckheim* (J. D. Smith, no. 643). Same locality, *J. D. Smith* 1572. Cobán, Alta Verapaz, alt. 1,350 meters, *von Türckheim* II. 1397; II. 2437.

COSTA RICA: Vicinity of La Palma, alt. 1,450 to 1,550 meters, on tree trunks at edge of forest, *Maxon* 449 (type locality of *P. plebejum palmense* Christ).

COLOMBIA: Dense forests near Popoyán, alt. 1,750 meters, *Lehmann* 3556. Same general region, alt. 1,600 to 2,000 meters, *Lehmann* 5724.

VENEZUELA: Los Tegües, alt. 1,150 meters, *Eggers* 13041.

ECUADOR: Mount Tunguragua, alt. 1,600 to 2,300 meters, *Lehmann* 460.

**17. *Polypodium plebejum* Schlecht. & Cham. Linnaea 5: 607. 1830.**

*Polypodium karwinskyanum* A.Br.; Mett. Abh. Senckenb. Ges. Frankfurt 2: 66. 1856, in part.

*Polypodium cheilostictum* Fée, Mém. Foug. 8: 87. 1857.

*Polypodium plebejum cooperi* Baker, Journ. Bot. Brit. & For. 25: 25. 1887.

TYPE LOCALITY: Jalapa, Mexico (*Schiede* 746).

DISTRIBUTION: Eastern central Mexico to western Panama, ascending to 2,400 meters in Panama, but occurring mainly at lower altitudes.

The type collection of *P. plebejum*, from Jalapa, which is in the humid region of the eastern part of southern Mexico, has not been seen by the writer; but from this general region and the area southward of Costa Rica there is at hand a wealth of material which seems to place the identity of this species beyond question. These specimens include several collections so determined by Hieronymus and the whole range of North American specimens cited below doubtless pertains to a single species. The South American material previously so referred must probably all be excluded, the wide distribution hitherto ascribed to the species having been due mainly to a lack of critical study.

Both in size and shape of the fronds and segments *P. plebejum* varies widely. The largest plants seen (*Pringle* 3258) have the fronds about 50 cm. long, the stipe and lamina being about equal in length. The rhizome is stout and ropelike, very thickly covered with short, very closely packed, brownish, crispate, divergent but scarcely projecting scales; and, since it is mostly epigeal, these are conspicuous, especially in the long-produced apical portion which commonly extends beyond the fronds a distance of 3 to 10 centimeters. This is in sharp contrast to *P. guttatum*. The scales of the under side of the lamina are the best specific mark; they are usually very few and minute, 0.5 to about 1 mm. long, deltoid-lanceolate or nearly linear from a short triangular base, the margins subentire to irregularly and for the most part bluntly bidenticulate, never having the long, slender, almost cilia-like teeth of *P. oulolepis*. In all of the specimens here listed the sori are distinctly impressed at maturity.

*Polypodium cheilostictum* Fée, described upon specimens collected at Orizaba by W. Schaffner (no. 543) in 1856, is probably synonymous with *P. plebejum*, though listed by Fournier as distinct. The type locality is not far from that of *P. plebejum* and the description indicates no points of difference.

*Polypodium karwinskyanum* A. Br., which was first definitely described by Mettenius, seems to be mainly this species, although according to Kuhn and



Hieronimus, who have presumably examined the original specimens, it is also partly *P. leucosticton*.

The following specimens are in the U. S. National Herbarium:

MEXICO: Jalapa, Veracruz, *Orcutt* 2806. Region of Orizaba, *Bourgeau* 2895 (distributed as *P. cheilostictum*). Córdoba, Veracruz, *Fink* 61, 73. Zacuapan, Veracruz, *Purpus* 4375. Teziutlán, Puebla, *Orcutt* 4032. Boca del Monte, Puebla, *Purpus* 6426. Near Pantepac, Chiapas, *Collins & Doyle* 221. Tamasopo Canyon, San Luis Potosí, *Pringle* 3258.

GUATEMALA: Cobán, Alta Verapaz, alt. 1,300 meters, *J. D. Smith* 1573; *von Türckheim* (J. D. Smith, no. 641); *von Türckheim* II. 1256. Near the Finca Sepacuité, Alta Verapaz, *Goll* 191; *Cook & Griggs* 541. Trail between Sepacuité and Secanquím, Alta Verapaz, alt. 1,000 meters, *Maxon & Hay* 3285. San Miguel Uspantán, Depart. Quiché, alt. 1,800 meters, *Heyde & Lux* (J. D. Smith, no. 3255). Santa María, Depart. Quezaltenango, *Kellerman* 5572.

COSTA RICA: Cartago, alt. 1,275 meters, *Cooper* (J. D. Smith, no. 6054). Tablazo, alt. 1,900 meters, *C. Brade*; *Biolley*. Several sheets without exact locality, *Cooper*; *Wercklé*.

PANAMA: Above Camp Aguacatal, eastern slope of Chiriquí Volcano, alt. 2,400 meters, *Maxon* 5301. Above the Río Ladrillo, southern slope of Cerro de la Horqueta, Chiriquí, alt. 1,200 to 1,700 meters, *Maxon* 5408.

18. *Polypodium tweedianum* Hook. Icon. Pl. 1: pl. 86. 1837. PLATE 39.

? *Polypodium sporadolepis* Kunze var. *a* Mett. Abh. Senckenb. Ges. Frankfurt 2: 67. 1856.

*Lepicystis macrocarpa* Diels in Engl. & Prantl, Pflanzenfam. 1<sup>4</sup>: 322. 1899, in part; not *Polypodium macrocarpum* Presl, 1825.

TYPE LOCALITY: Woods of St. Xavier, Tucumán, Argentina (*Tweedie*).

DISTRIBUTION: Bolivia and northern Argentina, and probably northward in the Andes.

ILLUSTRATIONS: Hook. op. cit. pl. 86; Diels in Engl. & Prantl, Pflanzenfam. 1<sup>4</sup>: f. 167. C. (as *Lepicystis macrocarpa*).

In the course of an attempt to reconcile the several conflicting concepts of this species and its nearest allies and to determine, if possible, the precise original application of the name *P. tweedianum*, the writer has sought the loan of a portion of Tweedie's type specimen, shown in Hooker's plate 86, and has been informed that this specimen is not now to be found at Kew. It seems necessary, therefore, to interpret the species solely from Hooker's illustration, and this, in the light of a recent single collection by K. Fiebrig in southern Bolivia, does not appear to be very difficult. The plants referred to are Fiebrig's no. 3265,<sup>1</sup> from Pinos, near Tarija, Bolivia, which agree well with Hooker's illustration of Tweedie's type specimen from the northernmost part of Argentina. Although some of the fronds are larger than Tweedie's, the proportionate length of lamina and stipe is about the same, as also the general form and cut of the lamina, the direction, shape, and number of the segments, and the position and number of the sori. A difference is noted in the more broadly alate bases of the segments of no. 3265, especially upon the distal side, but this is not very pronounced and is perhaps no more than an individual variation.

Interpreted upon the basis of Fiebrig's plants, *P. tweedianum* shows an unmistakable alliance with *P. plebejum* and nearest relatives in several par-

<sup>1</sup>The specimens studied are in the Gray Herbarium and in the U. S. National Herbarium.





K. Fiebrig: Plantae austro-bolivienses 1903-1904.  
3265. *Polypodium macracarpum*  
Presl. var.  
Kunze  
Farija  
12. 11. 14

POLYPODIUM TWEEDIANUM HOOK.



ticulars, notably in its strongly cartilaginous leaf margins and in the character of its scales. The rather wide-creeping rhizome (2 to 3 mm. in diameter) has a very dense covering of closely imbricate scales. These are mostly roundish-ovate to broadly oblong, 1.5 to 2.5 mm. long, acuminate, fragile, conspicuously and narrowly fuscous-carinate, the broad, pale brown borders distinctly repand but scarcely complicate-crispate, the margins irregularly erose. The scales of the lamina are numerous, but mostly not contiguous, 1 to 1.5 mm. long, deltoid-ovate, abruptly long-attenuate, pale brown, with a darker center, coarsely and deeply denate, the teeth bipapillate. They agree fairly well with the rough drawing of the scales of *P. tweedianum* given by Hooker, much better, in fact, than do those of specimens referred to *P. tweedianum* by Hieronymus.

Hieronymus<sup>1</sup> has mistakenly listed under *P. tweedianum* at least two specimens (*Rusby* 352, 353) which the writer believes to represent a new species, *P. rusbyi* (p. 570). The plants so referred have the fronds larger and decidedly more lax than those shown in Hooker's plate, with the segments less ascending, even spreading. They clearly do not pertain to Hooker's species.

Christ reported *P. tweedianum* from Costa Rica in 1906<sup>2</sup> upon the basis of specimens collected by Wercklé, Pittier (840, 13257), and Tonduz (16716), although at least one of these numbers (*Pittier* 13257) had previously<sup>3</sup> been listed by him as belonging to his new variety, *Polypodium plebejum costaricense*. Subsequently<sup>4</sup> this variety was reduced by him to *P. leucosticton*, in which species, as now understood, it is certainly to be included. Under these circumstances it is exceedingly doubtful if *P. tweedianum* should be recognized as a member of the North American flora. No specimens from this region have been seen by the writer, at least.

EXPLANATION OF PLATE 39.—Bolivian specimens of *Polypodium tweedianum* (*Fiebrig* 3625, U. S. Nat. Herb. no. 694023; ex Herb. Gray). Scale  $\frac{1}{2}$ .

#### 19. *Polypodium guttatum* Maxon, sp. nov.

PLATE 40.

Rhizome wide-creeping, mostly hypogean, tortuous, rarely branched, 2 to 3 mm. in diameter, freely radicle on all sides, densely paleaceous, the scales fragile, closely impacted, broadly ovate-oblong, 1 to 1.5 mm. long, yellowish, deeply fimbriate-lacerate, crispate, with a linear or very narrowly triangular median stripe of elongate blackish cells, these having the outer walls semitranslucent and the partition walls blackish and very strongly sclerotic, the lumen often obsolete. Fronds few, 1 to 3 cm. apart or two borne together, 15 to 35 cm. long, erect; stipe 10 to 20 cm. long, 1 to 1.5 mm. thick, yellowish to pale olivaceous or darker at the base, subterete to angulate, faintly foliaceo-marginate, or noticeably so at the apex; lamina narrowly to broadly oblong or deltoid-oblong, acute, rather abruptly short-caudate, 7 to 22 cm. long, 4 to 12 cm. broad, subpinnatisect throughout, the stout stramineous rachis very strongly elevated; segments 12 to 16 pairs, patent, linear to linear-oblong, often narrowed just above the base, obtuse or acutish, 4 to 10 mm. broad, the lower ones once or twice their width apart, those above gradually closer but never contiguous, all of them dilatate or at least decurrent, connected by an oblique foliaceous wing 0.5 to 2 mm. broad upon each side of the rachis; margins strongly callous, minutely and remotely notched, repand in drying; veins 14 to 18 pairs, concealed, free, spreading, 2 to 4-forked, the large sori terminal upon the elongate first branch, slightly nearer to the margin than to the midrib. Leaf tissue very

<sup>1</sup> Bot. Jahrb. Engler 34: 520, 521. 1905.

<sup>2</sup> Bull. Herb. Boiss. II. 6: 50. 1906.

<sup>3</sup> Bull. Herb. Boiss. II. 5: 4. 1905.

<sup>4</sup> Bull. Soc. Bot. Genève II. 1: 219. 1909.



thick, rigidly spongiöse-coriaceous, the upper surface light or grayish green, glabrous, and non-paleaceous, the lower surface grayish green to distinctly yellowish,<sup>1</sup> glabrous, obviously but sparsely paleaceous, the scales broadly ovate to deltoid-ovate, long-acuminate, 1 to 1.5 mm. long, attached above the cordate base, castaneous, slightly paler toward the irregular bidentate margins, the cells mostly short to elongate-hexagonal, their outer walls transparent, the partition walls thick but yellowish-translucent; marginal row of cells transversely linear.

Type in the U. S. National Herbarium, no. 336056, collected near Saltillo, State of Coahuila, Mexico, altitude about 1,600 meters, April 15 to 30, 1898, by Dr. Edward Palmer (no. 65). A second sheet of the same number is also at hand.

The present species has hitherto been included in *P. plebejum* by Eaton, Davenport, and the writer in reporting upon the collections of Dr. Edward Palmer, who is apparently almost the only one to have collected it. The ample material brought together by him is singularly uniform and indicates that this is the dominant and characteristic member of the *plebejum* group in the States of Coahuila and San Luis Potosí.

*Polypodium guttatum* is at once distinguishable from the allied species *P. plebejum* and *P. oulolepis* by its different aspect and more particularly by the peculiarity of the scales of the lower side of the lamina. These in *P. plebejum* are rather slender, few, and often so minute as to be nearly invisible to the naked eye; whereas in *P. guttatum* they are more numerous and of different shape and though scattered are large and conspicuous, giving a speckled appearance to the lamina. *Polypodium oulolepis* also has numerous scales beneath, but they are narrowly attenuate and of different structure, being coarsely lacerate-dentate. Although the rhizome scales of all three species are similar, it may be noted that the median stripe in *P. plebejum* and *P. oulolepis* consists of black opaque cells so strongly sclerotic that their distinctness is lost, while in *P. guttatum* the lumina of the dark median cells are usually apparent, being often rather large.

Besides the type the following specimens are in the U. S. National Herbarium:

MEXICO: Same locality data as the type, *Palmer* 65½. Region of San Luis Potosí, alt. 1,800 to 2,400 meters, 1878, *Parry & Palmer* 973. Near San Luis Potosí, same State, *Palmer* 664 in 1898; *Palmer* 99 in 1902. Álvarez, State of San Luis Potosí, at base of trees and upon the shaded under side of large oaks, alt. 2,400 meters, *Palmer* 442 and 448½ in 1902. Mountains 12 to 14 leagues south of Saltillo, State of Coahuila, *Palmer* 1373 in 1880. Sierra de Pachuca, State of Hidalgo, *Rose & Painter* 6717. Without exact locality data, *J. G. Schaffner* 56.

EXPLANATION OF PLATE 40.—Blades of two middle-sized fronds of the type collection of *Polypodium guttatum*, the sterile one showing especially well the guttate under surface. Natural size.

20. *Polypodium oulolepis* Fée, Mém. Foug. 8: 86. 1857.

*Polypodium madrense* J. Smith in Seem. Bot. Voy. Herald 338. 1854.

TYPE LOCALITY: "Huatusco, Orizaba et au Popocatepetl, à 2,700 mètres d'altitude (W. Schaffner, nos. 191, 192 et 274 *partim*)."

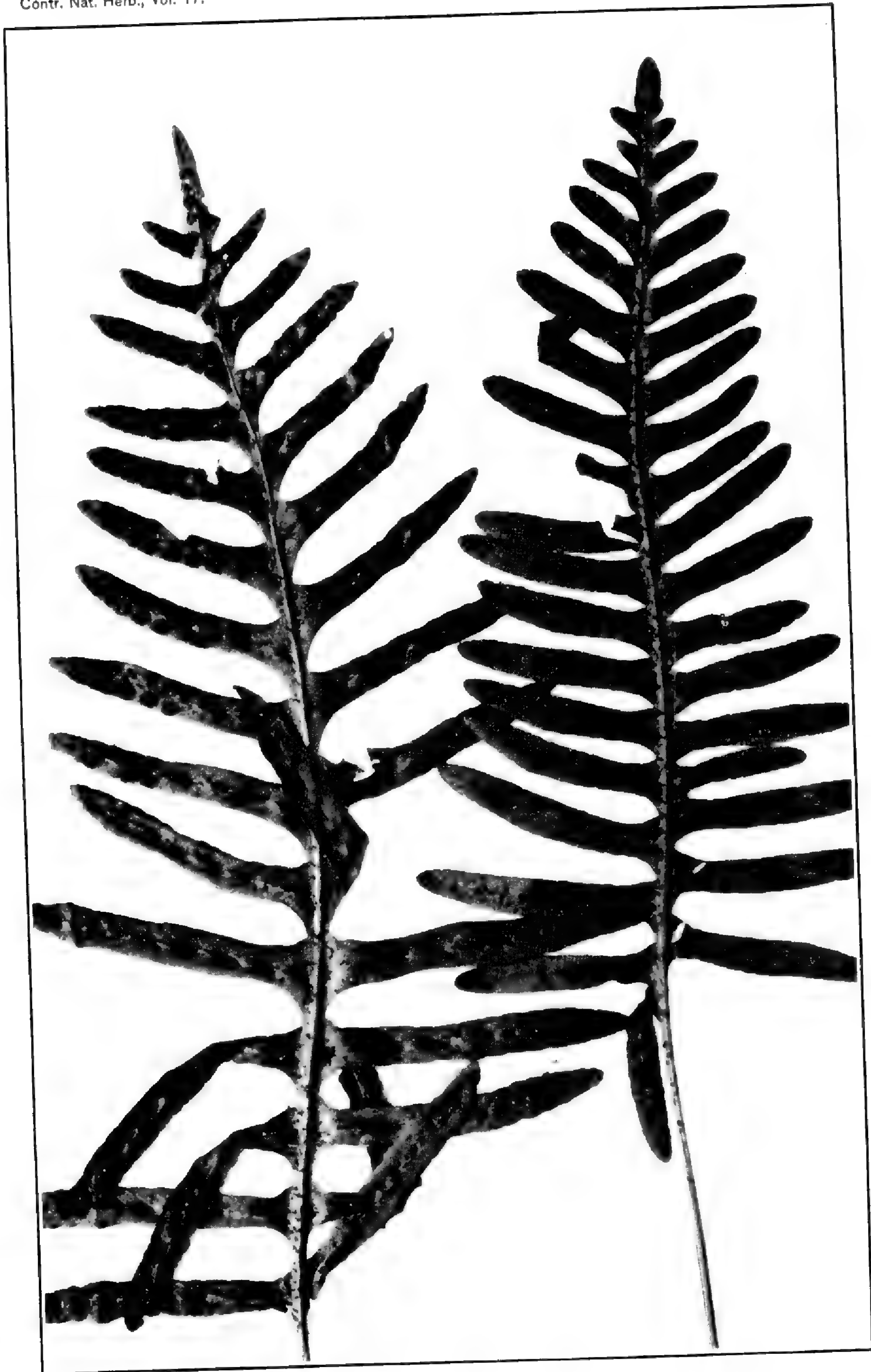
DISTRIBUTION: Central Mexico, at 2,400 to 2,700 meters altitude.

ILLUSTRATION: J. Smith, op. cit. pl. 73 (as *P. madrense*).

The species name *oulolepis* is applied as below partly from Fée's description but principally upon the basis of John Smith's illustration and of specimens

<sup>1</sup> "Olive ocher" and "sulphine yellow" of Ridgway's "Color Standards and Nomenclature," 1913.





POLYPODIUM GUTTATUM MAXON.



cited by Fournier. There can be no doubt that there are represented in *P. oulolepis*, *P. plebejum*, and the plant described in this paper as *P. guttatum*, three distinct specific forms, which, so far as the writer can perceive, show no signs whatever of intergradation. Although the rhizome scales of all three are crispate and are in general structure very similar to each other, the scales of the lower side of the lamina offer excellent distinctive characters. Those of *P. oulolepis* are narrow and coarsely lacerate-dentate, their slender tortuous apices greatly elongate and nearly filiform, as mentioned in the discussion of *P. guttatum*.

Fournier is clearly correct in regarding *P. madrense* as a synonym of *P. oulolepis*. Smith's larger figure illustrates the species tolerably well, especially in habit and in its representation of the straight, narrowly linear, distant segments, characters which may be well observed, for example, in Pringle's 11799; but the scales shown in the detailed figures are sketchily and inaccurately drawn, a significant and conclusive feature, however, being the deeply cleft margins.

The following specimens are in the U. S. National Herbarium:

MEXICO: On trees and rocks of lava fields near Eslaba, Federal District, alt. 2,400 meters, *Pringle* 11799. Region of San Luis Potosí, alt. 1,800 to 2,400 meters, *Parry & Palmer* 974. Near Santa Fé, Valley of Mexico, *Bourgeau* 684. Contreras, Valley of Mexico, *Orcutt* 3484. Popo Park, State of Mexico, *Hitchcock*. Near Cima, State of Mexico, *Rose & Painter* 7200. Near Toluca, State of Mexico, *Rose & Painter* 6798. Sierra de Tepostlán, State of Morelos, *Rose & Painter* 7252. Sierra de Pachuca, State of Hidalgo, *Rose, Painter & Rose* 8754; *Rose & Painter* 6717 in part. Between Pachuca and Real del Monte, State of Hidalgo, *Rose & Painter* 6658. Ixtaccihuatl, alt. 2,400 to 2,700 meters, *Purpus* 329; same region, 1905, *Purpus* 1593. Salto de Agua, State of Mexico, January, 1906, *Purpus* 1593. Cerro Azul, near Morelia, *Arsène*.

21. *Polypodium monosorum* Desv. Ges. Naturf. Freund. Berlin Mag. 5: 319. 1811.

*Polypodium onustum* Hook. Icon. Pl. 8: pl. 749. 1845.

*Polypodium macrosorum* Fée, Gen. Fil. 241. 1852, not Baker, 1885.

*Polypodium sporadolepis* var.  $\gamma$  Mett. Abh. Senckenb. Ges. Frankfurt 2: 67. 1856.

*Polypodium molestum* Mett. Ann. Sci. Nat. V. 2: 254. 1864.

TYPE LOCALITY: Peru.

DISTRIBUTION: Colombia to Peru, ascending to 3,400 meters.

ILLUSTRATIONS: Hook. op. cit. pl. 749 (as *P. onustum*); Fée, Mém. Foug. 6: pl. 8. f. 1. (as *P. macrosorum*).

In the group of species with dark-colored rhizome scales this is nearly the counterpart of *P. lindenianum* Kunze, of the group with larger, flaccid, light-colored thin-walled scales. It is a plant of very distinctive form and shows no near approach to *P. murorum*, which has very different scales and is at most only bipinnatifid.

The substitute name *molestum*, proposed by Mettenius in 1864, seems to have been quite unnecessary, since the plant which he described as "*P. onustum* Hook." in 1856<sup>1</sup> undoubtedly does appertain to Hooker's species of that name. This in turn is clearly conspecific with Fée's *P. macrosorum*, which Mettenius<sup>2</sup> had regarded as a form (var.  $\gamma$ ) of *P. sporadolepis*. All are doubt-

<sup>1</sup> Abh. Senckenb. Ges. Frankfurt 2: 68. 1856.

<sup>2</sup> Ibid. 2: 67. 1856.



less to be associated as *P. monosorum* Desv., as Hieronymus, determining the application of this name from Mettenius's notes, has stated.<sup>1</sup>

The following specimens are in the U. S. National Herbarium:

ECUADOR: Cerro de Pichincha, *Jameson*. Without exact locality, *Jameson*. Eastern Cordillera, alt. 3,400 meters, *Rimbach* (Rosenstock, no. 1). "An Bäumen auf dem Nudo de Tiripallo, dem Corazon, dem Pichincha, und auf der Montaña Mojanda, 3,000–3,400 m. 24. XII. 1880," *Lehmann* 431. Without definite locality, *Lehmann* 4448.

#### DOUBTFUL SPECIES.

##### 1. *POLYPODIUM ATURENSE* Maury, Journ. de Bot. 3: 134. f. 3. 1889.

Described and illustrated upon specimens said to have been collected in "bois humides des bords de l'Orénoque, Salvajito, Raudal d'Atures," by Gaillard (no. 111). Judging from the figure this is probably a distinct species, but it can hardly be placed definitely without an examination and comparison of the original specimens, these being apparently the only ones known.

##### 2. *POLYPODIUM BALLIVIANI* Rosenst. Repert. Nov. Sp. Fedde 9: 344. 1911.

Founded upon specimens collected at Antahuacana, Bolivia, in the valley of the Río Espíritu Santo, altitude 750 meters, June, 1909, by Dr. O. Buchtien (no. 2169). Not seen by the writer. According to the ample description it is a strongly characterized species of the group of *P. plebejum*, but not very closely related to that species itself.

##### 3. *POLYPODIUM BUCHTIENII* Christ & Rosenst. Repert. Nov. Sp. Fedde 5: 237. 1908.

Described from specimens collected at Unduavi, Bolivia, altitude 3,300 meters, upon trunks of trees in forests, February 12, 1907, by Dr. O. Buchtien (no. 880). Not seen by the writer. Rosenstock contrasts it with *P. plebejum*, from which it is apparently distinct, especially in scale characters.

##### 4. *POLYPODIUM FRASERI* Mett.; Kuhn, Linnaea 36: 137. 1869.

Founded upon Ecuador specimens collected by Fraser; not known to the writer. From description a near ally of *P. plebejum*, but probably well marked by the form of the rather large scales of the lamina.

##### 5. *POLYPODIUM MASAFUERA* Phil. Linnaea 29: 107. 1857.

Described briefly from specimens collected by Germain upon Masafuera, one of the Juan Fernández group, belonging to Chile. Hooker<sup>2</sup> has figured as *P. macrocarpum* (*P. pycnocarpum*) a Masafuera specimen which agrees fairly well with the original description of *P. masafuerae* and seems to indicate that Christensen is correct in listing it as a valid species.

##### 6. *POLYPODIUM NIGRIPES* Hook. Sp. Fil. 5: 17. 1863.

A peculiar form, described from Venezuela specimens collected by Fendler (no. 247), known to the writer only from an imperfect specimen of the original collection, in the herbarium of the College of Pharmacy, New York City. Notwithstanding its subphlebodioid venation the plant in general appearance and in scale characters is clearly allied to the forms grouped at present under *P. leucosticton*, rather than to *P. plebejum* (to which it is referred by Christensen). If it is recognized eventually as a distinct species it must be renamed, on account of a Javan species having been described as *Polypodium nigripes* in 1844. Kuhn's notes<sup>3</sup> upon *P. nigripes* Hook. should not be overlooked.

<sup>1</sup> Bot. Jahrb. Engler 34: 523. 1905.

<sup>2</sup> Cent. Ferns pl. 34. 1854.

<sup>3</sup> Abh. Naturf. Ges. Halle 11: 41. 1869.



7. *POLYPODIUM PLATYBASIS* Baker in Hook. & Baker, Syn. Fil. ed. 2. 511. 1874.

The present species, which was founded upon specimens collected near Salta, in the Andes of northwestern Argentina, by Pearce, seems from description to be related to *P. monosorum* and *P. murorum*. Christensen,<sup>1</sup> however, lists it as belonging to the subgenus *Goniophlebium* and as occurring in Guatemala, but upon what ground in either particular is not clear. It has not been seen by the writer.

8. *POLYPODIUM PLEOPELTIDIS* Fée, Crypt. Vasc. Brés. 1: 86. pl. 26. f. 1. 1869.

This species, which is known to the writer only from Fée's illustrations, was founded upon two Brazilian numbers collected by Glaziou (2459, 2817). It is referred by Christensen to *P. plebejum*, a species which it obviously resembles but which does not extend south of Panama, so far as the writer can find. Judging from the figures, *P. pleopeltidis* is more nearly related to certain of the forms included by Hieronymus in *P. leucosticton*.

9. *POLYPODIUM SEGREGATUM* Baker in Hook. & Baker, Syn. Fil. ed. 2. 510. 1874.

An Ecuadorean species, recognized by Christensen, founded upon plants collected in the Andes of Quito by Jameson. Not known to the writer.

10. *POLYPODIUM TÜRCKHEIMII* Christ, Bull. Herb. Boiss. II. 5: 254. 1905.

This, which was founded upon a single collection made by von Türckheim at Cubilquitz, Alta Verapaz, Guatemala, altitude 350 meters, and distributed by Capt. John Donnell Smith under no. 7721, is said by Christ to be exactly intermediate between *P. fallax* and *P. lindenianum*. It is unknown to the writer.

**POLYPODIUM SQUAMATUM AND ITS ALLIES.**

The grounds for referring *Lepicystis* to *Polypodium* have already been discussed briefly (p. 557). The present notes relate to the tropical American species with pinnatifid to pinnatisect lepidote fronds and more or less typical goniophlebioid venation. *Polypodium squamatum* and *P. lepidopteris* are representative of this group. While the extremes in both character and amount of scaly covering are not so great as in the group of free-veined lepidote species, the actual characters of scale structure are for the most part precise and sufficiently obvious to afford good recognition marks for the species. Of the 17 species here recognized 5 are described as new, and several, previously little known, are reinstated. Three doubtful species also are mentioned.

## KEY TO THE SPECIES.

Rhizome scales small, roundish to triangular-ovate,  
brownish fuscous, very closely appressed, contiguous  
or subimbricate.

Segments 3 to 6 (rarely 8) mm. broad; lower surfaces  
brown from the presence of very numerous  
contiguous or imbricate scales.

Sori 8 to 14 pairs, deeply immersed, the upper  
surface of the segment strongly embossed. 1. *P. myriolepis*.

Sori 20 to 30 pairs, nearly superficial. . . . . 2. *P. sanctae-rosae*.

Segments 9 to 13 mm. broad; lower surfaces green,  
bearing numerous distant minute roundish  
scales. . . . . 3. *P. collinsii*.

<sup>1</sup> Ind. Fil. 555. 1906.



Rhizome scales larger, variously shaped (never roundish), with long-acuminate to subacicular tips, straight to oblique or subsquarrose, very widely imbricate. Fronds distant, the rhizome relatively slender and wide-creeping.

Sori impressed, the upper surface of the segment strongly embossed.

Fronds large, short-stipitate; segments mostly long-acuminate; sori medial, up to 2.5 mm. broad.....

4. *P. macrolepis*.

Fronds much smaller, long-stipitate; segments rounded-obtuse; sori supra-medial, appearing submarginal, very much smaller.....

5. *P. polypodioides*.

Sori superficial or nearly so.....

6. *P. thyssanolepis*.

Fronds subfasciculate or, if somewhat apart, the rhizome (nos. 6 and 8 excepted) short-creeping and relatively very thick.

Rhizome scales light brown or grayish, often with a sharply defined fuscous median area.

Lamina bearing numerous contiguous or slightly imbricate, minutely denticulate scales beneath.....

7. *P. argentinum*.

Lamina densely covered beneath with widely imbricate, fimbriate scales.

Segments oblique, widely joined; dark stripes of rhizome scales nearly percurrent.....

8. *P. leucosporum*.

Segments spreading, narrowly joined; dark median area of rhizome scales basal only.....

6. *P. thyssanolepis*.

Rhizome scales dark castaneous to ferruginous, never sharply bicolorous.

Pinnæ distant, membranous, often bipartite or tripartite.....

9. *P. tridens*.

Pinnæ (segments) much closer, herbaceous to coriaceous, simple.

Fronds long-stipitate; lamina suborbicular to ovate-oval.....

10. *P. lepidotrichum*.

Fronds mostly very short-stipitate; lamina narrowly linear to linear-oblong.

Lamina gradually long-attenuate in the basal half, many pairs of lower segments minute or even vestigial.

Rhizome scales flaccid, mostly 4 to 7 mm. long, broadly linear-attenuate from a slightly broader base.....

11. *P. leptopteris*.

Rhizome scales more rigid, 2 to 3.5 mm. long, relatively broader at the base.



Scales of the lower surface of segments very numerous, oblique, forming a thick covering; rhizome scales linear-deltoid, attenuate, bright castaneous, concolorous..... 12. *P. bombycinum*.

Scales of the lower surfaces fewer, closely appressed, imbricate, forming a thin covering, pale castaneous, the margins lighter..... 13. *P. balaonense*.

Lamina not gradually long-attenuate from the middle, but narrowed (if at all) rather abruptly in the basal third.

Rhizome scales small, bristle-like, rigidly divergent, abruptly attenuate-acicular from a minute, roundish, appressed base..... 14. *P. pyrrholepis*.

Rhizome scales larger, widely imbricate, oblique or appressed, either linear-deltoid and attenuate or ovate-acuminate and gradually long-attenuate.

Sori superficial, the upper side of the segments not at all embossed..... 15. *P. rosei*.

Sori somewhat impressed, the segments distinctly embossed above.

Scales of the lower side of the segments very slender, imbricate, but forming a thin covering..... 16. *P. squamatum*.

Scales of the lower side much broader, more numerous, widely imbricate, forming a very dense thick covering..... 17. *P. fimbriatum*.

1. *Polypodium myriolepis* Christ, Bull. Soc. Bot. Belg. 35: 224. 1896; Bull. Herb. Boiss. 4: 661. October, 1896.

*Polypodium costaricanum* Hieron. Bot. Jahrb. Engler 34: 530. 1904, not *P. costaricense* Christ, 1896.

*Polypodium wendlandii* Hieron. Hedwigia 44: 180. 1905.

TYPE LOCALITY: La Palma, Costa Rica, altitude 1,500 to 1,700 meters (*Tonduz* 9692).

DISTRIBUTION: Mountains of Costa Rica and western Panama, at 1,300 to 2,000 meters altitude.

The nomenclatorial history of this species has been rather confusing. In the first place, it was described as new twice by Christ in the same year under the same name, the order of publication probably being as above indicated. In



1904 it was again described, by Hieronymus, as *P. costaricanum*, for which the substitute name *P. wendlandii* was proposed by himself in 1905 because of an earlier *P. costaricense* Christ (1896). A careful reading of Hieronymus's description shows beyond doubt that his species is exactly *P. myriolepis* Christ.

In the meantime Christ had referred<sup>1</sup> specimens of his own *P. myriolepis* to *P. skinneri* Hook., a free-veined plant of Guatemala and Mexico properly known as *P. cryptocarpon*; and a few years later<sup>2</sup> he formally reduced *P. myriolepis* to that species, citing by number two Guatemalan specimens in Captain Smith's herbarium as agreeing exactly with Costa Rican material described as *P. myriolepis*. Both of these specimens are at hand, and neither of them represents *P. skinneri*. One (Lehmann 1487) is *P. platylepis* Mett., a free-veined species related to *P. furfuraceum* and *P. skinneri*; the other (Heyde & Lux 6288) is *P. sanctae-rosae* (Maxon) C. Chr., a species with regularly goniophleboid venation resembling that of *P. myriolepis*, but a plant widely different in most other characters. Apparently *Polypodium skinneri* was unknown to Christ both then and at a later time when, in properly restoring<sup>3</sup> *P. myriolepis* as a valid Costa Rican species, he nevertheless stated that Wercklé had collected a single specimen of true *P. skinneri* in Costa Rica. The writer has seen no specimen of "*P. skinneri*" from the region south of Guatemala, and seriously doubts the occurrence of this species (*P. cryptocarpon*) in Costa Rica.

As observed by the writer at the type locality and in western Panama *P. myriolepis* grows upon the trunks of living trees and on logs, and particularly about the bases of forest trees. The sinuous rhizomes are wide-creeping and only lightly attached to the substratum. Although covered with very numerous scales, they are perfectly smooth to the touch, owing to the fact that these are exceedingly minute, centrally peltate, and very closely appressed to the rhizome, their paler borders not at all projecting. A similar condition prevails in *P. collinsii*, a species very different in most particulars. In *P. sanctae-rosae* the rhizome scales are very much larger and vary from ovate to deltoid-ovate, as mentioned under that species. See also under *P. macrolepis*.

The following specimens are in the U. S. National Herbarium:

COSTA RICA: Forests of La Palma, alt. 1,450 to 1,550 meters, *Tondus* 9692, 12570; *Maxon* 477. Cartago, alt. 1,300 meters, *Cooper* (J. D. Smith, no. 6047). Tablazo, alt. 1,900 meters, *Biolley* 56. Volcán de Poás, alt. 2,000 meters, *Alfaro* 115.

PANAMA: Humid forest along the Upper Caldera River, near Camp I, Holcomb's Trail, above El Boquete, Chiriquí, alt. 1,450 to 1,650 meters, *Maxon* 5709.

**2. *Polypodium sanctae-rosae* (Maxon) C. Chr. Ind. Fil. Suppl. 62. 1913.**

*Goniophlebium sanctae-rosae* Maxon, Contr. U. S. Nat. Herb. 13: 8. 1909.

TYPE LOCALITY: Near Santa Rosa, Baja Verapaz, Guatemala, altitude about 1,600 meters (*von Türckheim* II. 1607).

DISTRIBUTION: Mountains of southern Mexico and Guatemala, at 1,000 to 1,800 meters altitude.

A strongly characterized species which ought not to be confused readily with any other. From the Costa Rican *P. myriolepis* it differs obviously in its thicker and less widely creeping rhizomes, its more numerous and nearly superficial sori, and in the paleaceous covering of both rhizome and lamina. The

<sup>1</sup> In Pittier, Prim. Fl. Costar. 3: 17. 1901.

<sup>2</sup> Bull. Herb. Boiss. II. 5: 4. 1905.

<sup>3</sup> Bull. Soc. Bot. Genève II. 1: 220. 1909.



rhizome scales are very many times larger than those of *P. myriolepis* and are ovate to deltoid-ovate, rather than suborbicular. The scales of the lower side of the lamina are acicular from a small subovate base and are so numerous and so widely imbricate as to wholly obscure the leaf surface; whereas those of *P. myriolepis* are either roundish or deltoid and acuminate, and, though so numerous and closely placed as to give a brownish appearance to the lamina, are not very widely imbricate. The sori of *P. sanctae-rosae* are only very slightly impressed; those of *P. myriolepis* are borne so deeply within the leaf tissue that the upper side of the leaf is conspicuously embossed, the pocket-like cavities in which the sori are sunk standing as slender raised prominences about 1 mm. high. These particulars are not unimportant, considering the former confusion, to which reference has already been made (under *P. myriolepis*).

A number of additional specimens have been received since *P. sanctae-rosae* was described, extending its known range, but not materially changing its characters. The Mexican plant cited below, determined by Liebmann as *P. squamatum*, is somewhat atypical, differing in its more distant sori.

The material in the U. S. National Herbarium is as follows:

GUATEMALA: The type and two additional specimens of the type collection, *von Türckheim* II. 1607. Cerro Redondo, Depart. Santa Rosa, alt. 1,050 meters, *Heyde & Lux* (J. D. Smith, nos. 4084, 6288). San Miguel Uspantán, Depart. Quiché, alt. 1,800 meters, *Heyde & Lux* (J. D. Smith, no. 3257). Volcán de Atitlán, Depart. Sololá, *Kellerman* 5789. Villa Nueva, Depart. Amatitlán, alt. 1,050 meters, *Heyde & Lux* (J. D. Smith, no. 4689). Fiscal, alt. 1,110 meters, *Deam* 6225. Near Santa María, Depart. Quetzaltenango, *Kellerman* 5571.

MEXICO: Hacienda de Mirador, February, 1843, *Liebmann* 111.

### 3. *Polypodium collinsii* Maxon, sp. nov.

PLATE 41.

Rhizome wide-creeping, sinuous, cordlike, wholly epigean, at intervals freely radicle beneath (the rootlets brownish-tomentose, densely clustered), 6 to 8 mm. in diameter, irregularly sulcate, obtusely angled, smooth, but very densely covered with minute peltate imbricate scales, these suborbicular, 0.5 to 0.75 mm. broad, minutely fimbriate, reddish brown with fuscous centers, the cells short, subhexagonal, with sclerotic partition walls. Fronds apparently erect, 55 to 62 cm. long, the stipe slightly shorter than the lamina; stipe about 25 cm. long, 2.5 to 5 mm. in diameter, deeply and irregularly sulcate, smooth, very closely covered with minute brownish peltate scales like those of the rhizome; lamina 30 to 35 cm. long, 14 to 20 cm. broad, broadly oblong or oval, scarcely or not at all reduced at the base, pinnatisect, abruptly short-acuminate, the terminal segment about 7 cm. long, nearly conform, slightly larger than those next below; pinnae 14 to 18 pairs, slightly ascending, mostly 7 to 11 cm. long, 9 to 13 mm. broad, nearly linear, entire, the lower ones dilatate or slightly excised below and surcurrent, their own width apart, the middle and upper ones closer (the obtuse sinuses 4 or 5 mm. broad), fully adnate, slightly dilatate, all the pinnae broadest in their lower third, thence gradually narrower toward the long-attenuate slender apex; veins oblique, immersed, atypically goniophleboid, a single row of broad soriferous areoles borne upon each side of the elevated blackish costa, an incomplete minor row beyond, with numerous free excurrent branches; sori 14 to 22 pairs, large, partially immersed in the rigid coriaceous leaf tissue (the upper side of the pinna thus coarsely mamilllose), borne midway between the midrib and margin, terminal upon the simple included veinlet of the areole or, commonly, the veinlet acutely once forked, both branches extending to the sorus. Lower leaf surface bearing numerous distant pale dark-



centered scales similar in structure to those of the rhizome, but more deeply fimbriate, mostly roundish, 0.4 or 0.5 mm. broad, sometimes deltoid, long-acuminate, and nearly 1 mm. long; scales of the upper surface minute, whitish, substellate, the divisions spreading and unequal.

Type in the U. S. National Herbarium, no. 574354, collected near Pantepec, Chiapas, Mexico, altitude 1,540 meters, January 16, 1907, by G. N. Collins and C. B. Doyle (no. 227). The specimen consists of two complete fronds attached to portions of the rhizome.

*Polypodium collinsii* has no especially close allies. The characters offered by its smooth, sinuous rhizomes, closely appressed, minute, peltate rhizome scales, and very minute, roundish scales of the under side of the lamina suggest a relationship with *P. myriolepis*; but it differs from *P. myriolepis* wholly in gross morphology. The scales of the under side of the lamina are numerous, but so far apart that the yellowish green leaf surface is not obscured. In dimensions and leaf shape only *P. collinsii* recalls *P. lepidotrichum*; but that is a species with subfasciculate fronds and very long, nearly capillary, ferruginous rhizome scales, and with at least part of the imbricate or contiguous scales of the lower side of the lamina long-aristate from a rounded base.

EXPLANATION OF PLATE 41.—The larger of the two type fronds of *Polypodium collinsii*. Scale  $\frac{1}{2}$ .

#### 4. *Polypodium macrolepis* Maxon, sp. nov.

Rhizome epiphytic, wide-creeping, sinuous, with a few short or elongate branches, radicose at intervals (the rootlets brownish-tomentose, freely branched), 3 to 5 mm. in diameter, flattish in drying, very firm, densely covered with straight, elongate, widely imbricate scales, these 3 to 4 mm. long, 0.65 to 0.85 mm. broad, narrowly deltoid-oblong, long-attenuate to a subflexuous tip, bicolorous, the broad median portion castaneous, the cells of the basal part mostly short, hexagonal, thick-walled, with closed or concealed lumina, those of the middle and apical part gradually longer and paler, at length narrowly linear and acute; borders pale, the cells in many rows, mostly linear, indistinct; margins deeply denticulate, the teeth bifid, variously curved. Fronds distant, rigid, ascending or erect, 20 to 40 cm. long, the stipe much shorter than the lamina; stipe 4 to 10 cm. long, 1 to 2 mm. thick, flattish, often tortuous, smooth, closely paleaceous, the scales mostly like those of the lower side of the lamina; lamina 13 to 28 cm. long, 5 to 9 cm. broad, oblong to lanceolate-oblong, not or scarcely reduced at the base, here fully pinnate, nearly so throughout, long-caudate, the apical pinnae long, abruptly discontinuous; rachis stout, paleaceous beneath like the stipe; pinnae 15 to 20 pairs, slightly ascending, 3 to 5 cm. long, 4 to 6 (7) mm. broad, linear to linear-lanceolate, acute or mostly long-acuminate, entire, the 2 or 3 lower pairs distant, broadly excavate to the midrib below, slightly constricted above; middle pinnae closer, more oblique, fully adnate, slightly decurrent, faintly joined, the sinuses obtuse or broadly acutish; midveins not elevated above, slightly so beneath; veins oblique, deeply immersed, atypically goniophleboid, a row of elongate-oval areoles extending nearly to the margin, bordered by an incomplete second row of small alternate areoles, the latter without included veins, a few veinlets excurrent; sori 5 to 9 pairs, 1.5 to 2.5 mm. in diameter, round to oval, not contiguous, medial, impressed (the upper surface distinctly mamilliose), terminal upon the very oblique, usually simple, single, included veinlet of the areoles; sporangia glabrous, the annulus usually 18-celled; spores diplanate, granulose. Leaf tissue rigidly spongiose-herbaceous, dull green above, bearing numerous small distant peltate scales, these roundish or deltoid-acuminate, with minute brownish centers, the broad white borders fimbriate-denticulate; under surface closely paleaceous, the scales mostly con-





POLYPODIUM COLLINSII MAXON



tiguous, orbicular to ovate-deltoid, averaging 0.6 mm. broad, peltate, brownish, with delicately toothed yellowish borders.

Type in the U. S. National Herbarium, no. 675627, from tree trunks and logs in forest near Camp Aguacatal, eastern slope of Chiriquí Volcano, Panama, at an altitude of 2,100 to 2,300 meters, March 10 to 13, 1911, by William R. Maxon (no. 5278).

The specific name *macrolepis* is chosen particularly by way of emphasizing the contrast afforded by the rhizome scales of this species to those of its nearest relative, *P. myriolepis* Christ, with which species it might casually be confused. From *P. myriolepis* it differs, nevertheless, not only in its elongate, widely imbricate rhizome scales, which are many times larger and of wholly different character (as described elsewhere), but also in its decidedly fewer, more oblique, and abruptly discontinuous segments and in its very much larger and less deeply immersed sori. In addition, it occupies a higher altitudinal range.

Besides the type, the following specimens of *P. macrolepis* are in the National Herbarium:

PANAMA: Cuesta Grande, eastern slope of Chiriquí Volcano, alt. 2,600 to 2,900 meters, *Maxon* 5312.

COSTA RICA: Volcán de Turrialba, alt. 2,500 meters, *Alfaro* 55.

5. *Polypodium polypodioides* (L.) Hitchc. Rep. Mo. Bot. Gard. 4: 156. 1893.

*Acrostichum polypodioides* L. Sp. Pl. 1068. 1753.

*Acrostichum ferruginosum* L. Sp. Pl. ed. 2. 1525. 1763.

*Polypodium incanum* Swartz, Prodr. Veg. Ind. Occ. 131. 1788.

*Polypodium ceteraccinum* Michx. Fl. Bor. Amer. 2: 271. 1803.

*Polypodium velatum* Schkuhr, Krypt. Gewächs. 1: 188. pl. 11b. 1809.

*Marginaria minima* Bory, Dict. Class. 10: 177. 1826.

*Polypodium squalidum* Vell. Fl. Flum. 11: pl. 76. 1827; Arch. Mus. Nac. Rio Janeiro 5: 449. 1881.

*Marginaria incana* Presl, Tent. Pter. 188. 1836.

*Goniophlebium incanum* J. Smith, Journ. Bot. Hook. 4: 56. 1841.

*Lepicystis incana* J. Smith, Lond. Journ. Bot. 1: 195. 1842.

*Polypodium microlepis* Fée, Gen. Fil. 238. 1852; Mém. Foug. 6: 8. pl. 6. f. 2. 1854.

*Polypodium incanioides* Fée, Mém. Foug. 8: 88. 1857.

*Goniophlebium ceteraccinum* Fée, Crypt. Vasc. Brés. 1: 107. 1869.

*Goniophlebium microlepis* Fée, Crypt. Vasc. Brés. 1: 107. 1869.

*Marginaria polypodioides* Tidestrom, Torreya 5: 171. 1905.

*Polypodium mesetae* Christ, Bull. Herb. Boiss. II. 5: 49. 1905.

TYPE LOCALITY: "Habitat in Virginia, Jamaica."

DISTRIBUTION: Maryland and Kentucky to southern Missouri, southward to Florida and Texas and throughout tropical America generally (including the West Indies) to Argentina and Chile.

An ubiquitous species throughout a large part of its wide range, variable in most characters, but even its different forms too distinctive to permit its being confused with other species to any extent. The venation varies from goniophlebioid to that of Eupolypodium, and this in plants otherwise essentially identical, ranging from the southeastern United States through Mexico, Central America, and the West Indies to Brazil and Bolivia. Most plants from the regions just mentioned have the scales of the under side of the lamina varying from roundish to deltoid-ovate and acuminate or even attenuate, the roundish type perhaps predominating in plants of northerly distribution; but in certain small forms from Mexico and Costa Rica the scales are much more



slender, the extreme condition being found in a few individuals from Sonora and Chihuahua in which they are very densely imbricate and exactly acicular from a relatively short ovate base. A similarly wide variation is noted in the scales of the upper surface of the segments. These, though small and scattered, are easily evident and usually persistent in most tropical American specimens; in United States plants, however, the segments are nearly or quite devoid of any scales above. The rhizome scales are more nearly constant, but here also there is observed a very considerable variation in size, form, and color, which is not altogether dependent upon age or condition.

Another departure is found in the uniformly small plants of southern Brazil, Uruguay, and Argentina, which, though of rather distinct appearance, apparently do not merit recognition as a separate species, although twice given a name. The South African *P. eckloni* Kunze, also, though recognized by Mettenius, is very questionably distinct.

A more or less critical examination of the very large series of specimens at hand, moreover, shows plainly that we have in *P. polypodioides*, as in *Asplenium monanthes* L., previously discussed,<sup>1</sup> a genuinely polymorphic species, composed of numerous elements so closely interrelated and differing among themselves (often regionally) in such minute and variable degree that segregation is scarcely justifiable. The general character of the species is too unmistakable and the many forms are too obviously parts of a single species complex, their peculiarities often clearly due to unusual conditions of habitat or season.

One almost invariable characteristic of *P. polypodioides*, which will easily distinguish this species from *P. thyssanolepis*, its nearest ally, is found in the more or less immersed sori. These are always somewhat impressed, at least, and in a great majority of mature specimens they are so deeply set in pocket-like depressions of the leaf tissue that the upper side of the segment is strongly embossed, the location of the sori beneath being very plainly indicated by the double row of rounded protuberances.

**6. *Polypodium thyssanolepis* A. Br.; Klotzsch, Linnaea 20: 392. 1847.**

? *Polypodium lanuginosum* Nees, Linnaea 19: 683. 1847, not Schrad. 1824, nor Vell. 1827.

*Polypodium rhagadiolepis* Fée, Gen. Fil. 237. 1852.

*Goniophlebium rhagadiolepis* Fée, Mém. Foug. 7: 62. 1854.

*Goniophlebium thyssanolepis* Moore, Ind. Fil. 396. 1862.

*Polypodium aspidiolepis* Baker, Journ. Bot. Brit. & For. 25: 26. 1887.

*Polypodium purpusii* Christ, Bull. Herb. Boiss. II. 7: 416. 1907.

TYPE LOCALITY: Colombia.

DISTRIBUTION: Arizona; general throughout Mexico and Central America; less common in the Andine region of South America, but occurring from Venezuela to Peru and Bolivia; also in Jamaica; ascends to nearly 4,000 meters.

ILLUSTRATION: Fée, Mém. Foug. 7: pl. 19. f. 3 (as *G. rhagadiolepis*).

*Polypodium thyssanolepis*, described originally from Colombian specimens collected by Moritz (no. 22) and Otto (no. 896), is a well-known species and is here regarded in its usual and accepted sense. Its taxonomic history concerns principally the following names:

(1) *Polypodium rhagadiolepis* Fée. As stated long ago by Kuhn this name, given to specimens collected by Linden in "Cuba and Mexico," applies to *P.*

<sup>1</sup> Contr. U. S. Nat. Herb. 17: 150-152. pl. 1. 1913.



*thyssanolepis*. The confusion of locality data for certain of Linden's specimens has already been mentioned.<sup>1</sup> Fée's illustration well represents this species.

(2) *Polypodium aspidiolepis* Baker. An examination of ample material of this form, which seems to be restricted to Costa Rica, shows that not only in general proportions and vestiture but even in the minute structure of its rhizome and lamina scales it is exactly *P. thyssanolepis*. It occurs with the ordinary form of the species and differs from that only in its bipinnatifid condition, the dissection of the pinnæ being accompanied by a partial loss of areolation, as might be looked for. This relationship was recognized by Christ, who fully described this state from Costa Rica as *P. thyssanolepis* var. *bipinnatifidum*,<sup>2</sup> calling attention to *P. aspidiolepis* as being "according to description, an analogous plant."

(3) *Polypodium purpusii* Christ. This was described from specimens cultivated in Darmstadt by Dr. J. A. Purpus, the original plants having been collected at Pachuca, Mexico, by Dr. C. A. Purpus, in 1904, and is known to the writer from several fronds courteously forwarded to Washington by the former. These represent merely a juvenile condition of typical *P. thyssanolepis*.

The identity of *P. lanuginosum* Nees, mentioned by Christensen as a doubtful synonym of *P. thyssanolepis*, is problematical. It is not even apparent that it belongs in *Polypodium*. Moreover, the determination is not of great importance, since, as noted in the synonymy, the species name *lanuginosum* would be unavailable for use in this connection.

*Polypodium thyssanolepis*, though variable in size, is not readily confused with other species. Christensen ascribes it to Cuba, but that record probably results from the doubtful data of Linden's type of *P. rhagadiolepis*. The following specimens are in the U. S. National Herbarium:

ARIZONA: Conservatory Canyon, Huachuca Mountains, July to September, 1882, *Lemmon*. Ramsey Canyon, Huachuca Mountains, August 23, 1910, *Goodding* 761.

MEXICO: Cold cliffs, rocky hills near Chihuahua, *Pringle* 443. Pachuca, Hidalgo, *Orcutt* 3933; cultivated specimens, originally from the same locality, *Purpus* (type collection of *P. purpusii*). Near El Salto, Hidalgo, on calcareous cliffs, *Rose* 7057. Near Ixmiquilpan, Hidalgo, *Rose* 9042. Barranca de l'Alseseca, Puebla, June 12, 1912, *Arsène*. Alta Suz, Puebla, *Purpus* 2688. Region of San Luis Potosí, alt. 1,800 to 2,400 meters, *Parry & Palmer* 971. Santiago Papasquiaro, Durango, *Palmer* 458 in 1896. Near Durango, *Palmer* 885 in 1896. Otinapa, Durango, *Palmer* 359 in 1906. Orizaba, Veracruz, *Hitchcock; Seaton* 99; *J. G. Smith* 82. Near Jalapa, Veracruz, *Rose* 6361. Tonilá, Colima, *Jones* 506. Amecameca, *Purpus* 1825. Río Blanco, near Guadalajara, Jalisco, *Palmer* 730 in 1886; *Rose* 7503. Sierra Madre, west of Bolaños, Jalisco, *Rose* 3710. Near Chapala, Jalisco, *Rose* 7670, 7693. Near Plateado, Zacatecas, *Rose* 2797. Sierra Madre, Zacatecas, *Rose* 2399. Several localities in Valley of Mexico, *J. G. Schaffner* 63; *Fourgeau* 254, 2780; *Orcutt* 3647; *Rose* 6468, 8274, 9462, 11036. Eslaba, Federal District, alt. 2,400 meters, *Pringle* 11801. Toluca, Mexico, *Rose* 6797. Tultenango, Mexico, *Rose* 7856. Las Naranjas and San Luis, Oaxaca, *Purpus* 3154.

GUATEMALA: Depart. Huehuetenango, *O. & E. Seler* 2607.

COSTA RICA: Cartago, alt. 1,300 meters, *Alfaro* (J. D. Smith, no. 6955); *Eeyer* 21; *Biolley* 82; *Biolley* 85 (bipinnatifid form). San Rafael de Cartago, alt. 1,600 meters, *Pittier* 9721 (including bipinnatifid form).

<sup>1</sup> Pages 563, 564.

<sup>2</sup> Bull. Soc. Bot. Belg. 35: 223. 1896.



Valley of the Rancho Redondo, alt. 2,000 meters, *Pittier* 1120. Alto de Ochomogo, alt. 1,550 meters, *Tonduz* 10394 (bipinnatifid form). Without locality, *Wercklé* (bipinnatifid form, ex herb. Christ). Without locality, *Cooper*.

JAMAICA: Near or just below Cinchona, alt. 1,500 meters or less, *Clute* 144; *Hart* 51; *Underwood* 1629, 3245.

COLOMBIA: Near Medellin, *Charetier* 40.

VENEZUELA: Campo Alegre, *Eggers* 13416. Without locality, *Fendler* 252.

PERU: Without locality, *Ruiz* 4549. Hacienda Limón, *Osgood* 64.

BOLIVIA: Soratá, alt. 3,900 meters, *Rusby* 344.

## 7. *Polypodium argentinum* Maxon, sp. nov.

Rhizome epigeal, creeping, 1.5 to 2 mm. in diameter, copiously radicle beneath, closely covered with appressed widely imbricate scales, these 2 to 2.5 mm. long, oblong to narrowly deltoid-oblong, acute or acuminate, attached above the rounded base, pale brown in mass, bicolorous singly, the narrow median portion falling short of the apex, subopaque (the cells linear-oblong, acutish, with reddish brown outer walls, the partition walls not strongly sclerotic), the wide borders pale, almost transparent, each consisting of 3 to 5 rows of oblique, short or transversely linear, thin-walled cells, the margins subentire, minutely erose-crenulate. Fronds several, 8 to 10 cm. long, erect or arcuate, subfasciculate, borne 2 to 4 mm. apart; stipes 2.5 to 4 cm. long, pale brown, flattish, 1 to 1.2 mm. broad, narrowly bisulcate upon the anterior face, scantily paleaceous, the scales subappressed; lamina lance-oblong, 4 to 6.5 cm. long, 1.5 to 2.5 cm. broad above the base, pinnatifid throughout to within 2 mm. of the broad concealed costa; segments 8 to 10 pairs below the acuminate subcaudate apex, slightly ascending, the lower and middle ones nearly equal, oblong to linear-oblong, 1 to 1.5 cm. long, 3 to 4 mm. broad, rounded-obtuse, close, the sinuses linear, appearing broader from the contraction of the strongly coriaceous leaf tissue in drying, the margins entire, closely revolute; apical segments gradually shorter, the uppermost ones rounded-triangular; midveins of the segments impressed above, partially concealed beneath; veins of larger segments about 7 pairs, mainly joined, subgoniophlebioid, forming a single series of broad oblique areoles upon either side, these extending nearly to the margin, with several very short excurrent branches and a single included veinlet, the latter fertile at its extremity; sori 5 to 7 pairs, large, nearly medial, slightly concealed by the scales of the lower surface, these numerous, contiguous or subimbricate, pale brown, about 1 mm. long, broadly deltoid-ovate, acute or acuminate, peltate, firmly attached above their base, clathrate, nearly homogeneous, the cells mostly short, subhexagonal, with sclerotic yellowish brown partition walls and transparent outer walls, the outer 1 or 2 rows transversely linear or linear-oblong, thin-walled, the margin of the scale minutely denticulate.

Type in the U. S. National Herbarium, no. 691518, collected from rock clefts in the Sierra Ventana, Province of Buenos Aires, Argentina, March 3, 1881, by P. G. Lorentz.

The type specimens consist of two plants, received from Berlin, determined as *Lepicystis macrocarpa*. They are, however, far removed from *P. pycnocarpum* (*P. macrocarpum* Presl), not only by their widely different scale structure but likewise by their gross morphology and subgoniophlebioid venation. From small plants of true *P. tweedianum* they are immediately distinguished by their subgoniophlebioid venation, entire segments, coriaceous (not membranaceous) texture, and nonrepand rhizome scales, which, also, are of different structure. Although placed here among the species with anastomosing veins *P. argentinum* is nevertheless nearest related to the species of the *plebejum*



group, from all of which it differs in its mostly closed venation and in scale structure.

This is not improbably the species described and illustrated by Hooker and Greville as *Pleopeltis pinnatifida*, upon specimens collected upon the Cerro del Morro, San Luis, Argentina, by Gillies. These have not been examined by the writer. They came from the region of *P. argentinum* and, as illustrated, agree closely with the Lorentz specimens in general appearance. Their venation and minute scale characters are not described. *Pleopeltis pinnatifida* can, therefore, be cited at present only as a probable synonym of *P. argentinum*. The earlier *Polypodium pinnatifidum* of Gilibert,<sup>1</sup> 1792, would in any event preclude the transfer of *Pleopeltis pinnatifida* to *Polypodium* for this plant.

**8. *Polypodium leucosporum* Klotzsch, Linnaea 20: 404. 1847.**

*Pleopeltis leucospora* Moore, Ind. Fil. LXXVII. 1857.

*Lepicystis leucospora* Diels in Engl. & Prantl, Pflanzenfam. 1<sup>4</sup>: 324. 1897.

TYPE LOCALITY: Mérida, Colombia (Moritz 306).

DISTRIBUTION: Mountains of Colombia and Venezuela.

This is a peculiar species which has been redescribed by Mettenius,<sup>1</sup> Hooker,<sup>2</sup> and Hooker and Baker,<sup>3</sup> always rather inadequately and without indication of its true affinities. Thus Diels,<sup>4</sup> including it in the genus *Lepicystis*, places it in his section *Phlebolepicystis*, as a member of the *P. lanceolatum* group, which is essentially the alliance suggested by Mettenius. It seems to the writer that, notwithstanding the subphlebodioid venation, the relationship is rather with *P. thyssanolepis*. The single specimen in the U. S. National Herbarium (Lehmann 580, from Pasto, southern Colombia, altitude 2,544 meters, February 28, 1881) was in fact so determined by Hieronymus,<sup>5</sup> an error which though obvious enough is accounted for by the general similarity of these two species and the fact that the Lehmann plants of *P. leucosporum* are more regularly pinnatifid and more symmetrical than those of the type collection. The latter are known to the writer from a sketch, and from a single slightly lobate frond in the Underwood Herbarium, which in scale and sorus characters agree essentially with the Lehmann plants, differing only in the shape of the frond. Diels has suggested that *P. leucosporum* is perhaps an abnormal state of *P. lanceolatum* L., a simple-leaved species which does occasionally produce lobate fronds (the variety *elizabethae* Jenman);<sup>6</sup> but this supposition is readily disproved by an examination of the rhizome and lamina scales.

Chiefly from the new Lehmann material, therefore, *P. leucosporum*, which is believed normally to have regularly and deeply pinnatifid fronds, may be redescribed as follows:

Rhizome short-creeping, the few branches 2 to 5 cm. long, about 2 mm. in diameter, radicle beneath, densely covered with oblique or laxly appressed, widely imbricate scales, these 3 to 5 mm. long, narrowly oblong-lanceolate, long-attenuate, attached far above the rounded base, light brown in mass, bicolorous singly, the dark brown lance-attenuate median line extending nearly to the apex (the cells of this short to linear-oblong, subquadrate to hexagonal, with strongly sclerotic dark brown partition walls and hyaline outer walls, an

<sup>1</sup> Abh. Senckenb. Ges. Frankfurt 2: 89. 1856.

<sup>2</sup> Sp. Fil. 5: 76. 1864.

<sup>3</sup> Syn. Fil. 362. 1868.

<sup>4</sup> Engl. & Prantl, Pflanzenfam. 1<sup>4</sup>: 324. 1897.

<sup>5</sup> Bot. Jahrb. Engler 34: 531. 1905.

<sup>6</sup> Bull. Bot. Dept. Jamaica II. 4: 199. 1897.



elongate lumen invariably present), the whitish borders as broad or broader, composed of several rows of irregular, transparent, thin-walled, mostly transverse cells, the outermost row with their distal ends projecting, connivent in pairs, the free tips deeply bifid, the margin of the scale thus irregularly lacerate-denticulate. Fronds several, 5 to 10 mm. apart, rigidly erect, 15 to 23 cm. long, the stipe longer than the lamina; stipe 10 to 13 cm. long, 1.2 to 1.5 mm. thick, dull grayish brown, subterete, faintly bimarginate, deciduously paleaceous; lamina 8 to 10.5 cm. long, sometimes linear and nearly simple, 0.5 to 1.5 cm. broad, with a few low or irregularly elongate lobes, but normally deltoid to ovate, 3 to 4.5 cm. broad, abruptly acuminate and conspicuously long-caudate, very deeply pinnatifid or pinnately parted, densely paleaceous beneath, minutely and scantily so above, the principal segments (4 to 6 pairs) mostly less than their own width apart, 1 to 2.5 cm. long, 5 to 8 mm. broad, oblong to linear-oblong, rounded at the apex, decurrent, joined by a costal wing, this about 1 mm. broad upon each side of the stout, partially concealed, brownish rachis at the base, gradually very much broader toward the apex, the uppermost segments giving way abruptly to the broad crenations of the elongate apex; venation wholly concealed, goniophleboid or subphlebotoid, a row of large oblique elliptical areoles extending nearly to the margin, the few excurrent ultimate veinlets free or variously joined; sori 5 to 8 pairs, very large, dark brown, broadly oval, nearly medial, partially concealed by the scales, terminal upon one or both of the branches of the once forked included veinlet, or the fertile veinlet simple. Leaf tissue opaque, rigidly herbaceo-coriaceous; scales of the lower surface very numerous, widely imbricate, suborbicular to deltoid-ovate, 1 to 2 mm. long, yellowish brown in mass, with small dark brown centers, irregularly denticulate, the narrow teeth bipapillate at their extremity; scales of the upper surface similar but paler, narrower, and with much longer teeth.

Though confused with *P. thyssanolepis*, which is certainly a close ally, *P. leucosporum* differs widely in gross characters from adult specimens of that species in its pinnately parted, conspicuously long-caudate lamina and in its oblique, long-decurrent segments. As to minute characters, both the rhizome and lamina scales have the marginal teeth about half the length (or less) of those of *P. thyssanolepis*; and, under the microscope, the dark median area of the rhizome scales is seen to extend nearly to their slender tip, instead of being confined to the basal portion of the scale. The broadly joined segments of the lamina are sufficiently distinctive.

Aside from the specimens discussed above, *P. leucosporum* is known from at least two other collections: Colombia, *Burschel*, mentioned by Hooker; and Venezuela, *Fendler* 251, listed by Eaton.<sup>1</sup> Neither of these has been seen by the writer.

**9. *Polypodium tridens* Kunze, Farrnkr. 1: 23. 1840.**

TYPE LOCALITY: Galápagos Islands, Ecuador (*Cuming* 112).

DISTRIBUTION: Galápagos Islands.

ILLUSTRATION: Kunze, op. cit. *pl.* 13. *f.* 1.

This species which was known to its describer only from a single frond, is the subject of a subsequent note by Hooker,<sup>2</sup> who, basing his conclusions upon more ample material, was inclined to look upon the fronds with forked or tripartite pinnæ as atypical, the simply pinnate fronds representing the normal. The tendency toward bipartite or tripartite pinnæ seems, however, to be nor-

<sup>1</sup> Mem. Amer. Acad. n. ser. 8: 200. 1860.

<sup>2</sup> Hook. Sp. Fil. 4: 211. 1862.



mal. Of the single specimen of a different collection, cited below, two of the three fronds have simple pinnæ, while those of the third range from simple to subequally bipartite. This specimen has an incomplete rhizome which may be described as follows: Woody, horizontal, about 4 mm. in diameter, freely radicose on all sides, closely beset with rigid, oblique, imbricate scales, these 1.5 to 2 mm. long, narrowly deltoid, attenuate-acuminate, opaque, very dark-castaneous by transmitted light (otherwise appearing fuscous), with a paler, mostly narrow border of 3 to 6 rows of minute, short to irregularly oblong, subquadrate or polygonal cells, these with pale-castaneous partition walls and nearly transparent outer walls. The scales of the under side of the lamina have precisely the structure indicated by Kunze's illustrations.

Only the following specimen, collected during the cruise of the Bureau of Fisheries steamer *Albatross*, is at hand:

ECUADOR: Charles Island, Galápagos Group, April 8, 1888, *Leslie A. Lee*.

**10. *Polypodium lepidotrichum* (Fée) Maxon.**

*Goniophlebium lepidotrichum* Fée, Mém. Foug. 8: 93. 1857.

TYPE LOCALITY: Orizaba, Mexico (*Schaffner* 451).<sup>1</sup>

DISTRIBUTION: State of Veracruz, Mexico.

This species, though strongly marked and represented in herbaria by at least two widely distributed numbers (viz, *Bourgeau* 2883 and *Pringle* 5586), has been passed by for many years, partly because of inadequate material, and possibly also because of obvious deficiencies in the original description which made it difficult of application. If the two collections above mentioned are correctly referred to this species, the type specimen of which has not been seen, the number of segments (about 40 pairs) stated by Fée is certainly incorrect, the actual number being far less; but in most particulars his description exactly fits these plants. The fronds are 30 to 60 cm. long and subfasciculate, the stipe a little shorter than the suborbicular to ovate-oval lamina. The very thick, creeping rhizome is covered on all sides with a closely packed mass of slender, silky, ferruginous scales, these 4 to 6 mm. long, straight, nearly acicular, tapering gradually from the slightly rounded base, which is 0.5 to 0.7 mm. broad. The rhizome scales of no other species of the whole group of *P. squamatum* and *P. lepidopteris* approach these in slenderness.

The lamina is 20 to 35 cm. long, 16 to 20 cm. broad and embraces 10 to 17 pairs of linear, acute, entire pinnæ, the fully fertile pinnæ being 6 to 8 mm. broad, the sterile ones sometimes 15 mm. broad in their lower third. The lower surface bears numerous adjacent or contiguous, minute, closely appressed scales (these 0.6 to 0.7 mm. broad, with dark centers and broad, fimbriate, whitish margins), many of them with a long hairlike tip. The scales of the upper side are fewer, more deeply lacerate, and with a greatly elongate, setaceous tip, being more like those which thickly but laxly clothe the rachis and sulcate stipe.

In dimensions and general form of lamina only *P. lepidotrichum* suggests *P. collinsii*, with which species it is elsewhere compared. From *P. squamatum*, with which it was merged by Fournier, it differs widely in habit and in form of lamina, and wholly in the character of its rhizome scales.

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<sup>1</sup>*Schaffner* 198, from Córdoba, is also cited. This number appears to have been mixed with *Schaffner* 197, the type of *Goniophlebium pyrrholepis* Fée. At least, no. 198 at Kew, as represented by fragments in the Underwood Herbarium, is very clearly *P. pyrrholepis*, according to description and by comparison with very complete material of that species.



The following specimens are in the U. S. National Herbarium:

MEXICO: Region of Orizaba, Veracruz, *Bourgeau* 2883; *Pringle* 5586 (2 sheets); *Purpus* 5093; *Mohr*; *Chas. G. Wood*.<sup>1</sup> Jalapa, Veracruz, *Orcutt* 2839.

**11. *Polypodium lepidopteris* (Langsd. & Fisch.) Kunze, Linnaea 13: 132. 1836.**

*Acrostichum lepidopteris* Langsd. & Fisch. Icon. Fil. 1: 5. 1810.

*Polypodium sepultum* Kaulf. Enum. Fil. 104. 1824.

*Polypodium hirsutissimum* Raddi, Opusc. Sci. Bologna 3: 286. 1819; Pl. Bras. 1: 17. 1825.

*Polypodium rufulum* Presl, Del. Prag. 1: 164. 1822.

*Polypodium tricholepis* Schrad. Gött. Anz. Ges. Wiss. 1824: 867. 1824.

*Polypodium raddii* Desv. Mém. Soc. Linn. Paris 6: 232. 1827.

TYPE LOCALITY: Island of Santa Catharina, Brazil.

DISTRIBUTION: Brazil and Uruguay.

ILLUSTRATIONS: Langsd. & Fisch. op. cit. pl. 2 (as *A. lepidopteris*); Raddi, Pl. Bras. 1: pl. 26 (as *P. hirsutissimum*).

The above names are applied variously to several forms which, taken together, constitute a single species, *P. lepidopteris*, as currently understood. That this concept is erroneous seems probable, if we may judge from the diverse forms included. Material at hand is too incomplete, however, to more than suggest probable lines of segregation, and the critical revision of this species is accordingly deferred until it may be possible to study a sufficiently large series of complete individual plants.

**12. *Polypodium bombycinum* Maxon, sp. nov.**

Rhizome short-creeping, with numerous short closely clustered branches, these stout, 3 to 5 mm. in diameter, freely radicle, densely and divaricately paleaceous, the scales 3 to 4 mm. long, 0.7 to 0.8 mm. broad at the base, very gradually narrowed to a long linear-attenuate apex, castaneous, concolorous, the cells mostly very large, narrowly hexagonal to linear and sharp-pointed, with very strongly sclerotic partition walls and much thinner, slightly paler outer walls (lumina very narrow or wanting); margins of the scales beset with numerous straight or curved, divergent, acicular, cilia-like teeth, these mostly 0.12 to 0.17 mm. long, slightly cleft at the tip. Fronds several, stiffly erect, 5 to 7 mm. apart, nearly exstipitate (the stipe 0.3 to 2 cm. long), 17 to 45 cm. long, very densely appressed-paleaceous throughout; lamina subpinnatisect, linear to very narrowly linear-oblong, 2 to 4.5 cm. broad at the middle, attenuate to the acute, abruptly caudate apex, very gradually long-attenuate to the base, the 4 to 10 lowermost pairs of segments broadly deltoid, 2 to 5 mm. long; rachis stout, divaricately paleaceous, the scales of the lower side similar to those of the rhizome but shorter, narrower, and with relatively longer teeth; segments 35 to 60 pairs, divergent, about their own width apart, mostly 1 to 2.3 cm. long, 2.5 to 4 mm. broad, oblong to linear-oblong, acute, distinctly dilatate (with a minute distal auricle), connected by a faint wing, conspicuously paleaceous upon both surfaces; scales of the upper side yellowish white, numerous, rigid, imbricate, 3 to 4 mm. long, almost capillary, with a few long ascending teeth in the narrow basal part; scales of the lower side ferruginous, very numerous, oblique, densely imbricate, 3 to 4 mm. long, stiffly capillary-acicular from a minute few-celled deeply stellate base, minutely, obliquely, and distantly

<sup>1</sup> From a large specimen, in cultivation at the New York Botanical Garden, which was raised from a small plant taken from a tuft of a living orchid (*Gonogora truncata*) received from Mr. Charles G. Wood, Orizaba, in 1903.



toothed; venation wholly goniophleboid, a single row of oblique broadly elliptical areoles extending nearly to the margin, the few veinlets short and obliquely excurrent, free or forming an incomplete minor row of areoles; sori about 10 pairs, small, inframedial, terminal upon the short simple included veinlet, nearly concealed by the scales of the segment. Leaf tissue dull green, rigidly coriaceous-herbaceous.

Type in the U. S. National Herbarium, no. 833131, collected from trees and rocks, "Boqueron del Río Dagua," western Cordillera, Province of Cali, Colombia, altitude 300 to 1,000 meters, by F. C. Lehmann (no. 7666).

Related to *P. lepidopteris*, under which species it was listed by Hieronymus,<sup>1</sup> but differing widely not only in the form and cellular structure of its rigid (not flaccid) rhizome scales but also in the form and structure of the very abundant scales of the under surface of the lamina. The latter are exceedingly numerous and so closely placed and rigidly appressed-imbricate that their bases are completely obscured, the appearance being that of a very dense silky covering.

A single additional collection of *P. bombycinum* is in the National Herbarium:

PANAMA: Vicinity of Cana, Province of Panama, alt. 1,050 meters, June 3, 1912, *Goldman* 1915.

**13. *Polypodium balaonense* Hieron. Bot. Jahrb. Engler 34: 529. 1905.**

TYPE LOCALITY: Near Balao, Ecuador (*Eggers* 14286).

DISTRIBUTION: Ecuador.

This excellent species, which is undoubtedly the one mistakenly described by Sodiro<sup>2</sup> as *P. lepidopteris*, is briefly but adequately distinguished by Hieronymus. The scales of the rhizome may be further described as follows: 2.5 to 3.5 mm. long, light castaneous with paler borders, exactly ovate in the lower half, thence narrowly linear-attenuate, the borders throughout irregularly denticulate (closely so in the basal part), the teeth slender, sometimes connivent, deeply cleft at their tip, the two divisions often unequal; median cells of the basal portion mostly elongate-hexagonal, subopaque (open lumina mostly wanting), the partition walls very strongly sclerotic, with interior, transverse, elongate, moniliform thickenings.

The following specimens are in the U. S. National Herbarium:

ECUADOR: Balao, growing upon forest trees, January, 1892, *Eggers* 14286 (the type collection). Near El Recreo, Province of Manabi, *Eggers* 14873.

**14. *Polypodium pyrrholepis* (Fée) Maxon.**

*Goniophlebium pyrrholepis* Fée, Mém. Foug. 8: 94. 1857.

TYPE LOCALITY: Huatusco, Veracruz, Mexico (*W. Schaffner* 197).

DISTRIBUTION: Apparently confined to the State of Veracruz, Mexico.

This species, which was most injudiciously reduced to *P. lepidopteris* by Fournier,<sup>3</sup> and is so referred also in Christensen's Index Filicum, is represented in the National Herbarium by an excellent series of specimens, which show it to be an ally of *P. squamatum* rather than of *P. lepidopteris*. It differs from *P. lepidopteris* in its longer stipes, in its broader, nonattenuate laminae, and in the form and structure of its rhizome scales (these divergent, rigidly bristle-like in general appearance, 2.5 to 4.5 mm. long, abruptly attenuate-acicular from a small roundish or narrowly ovate base and very highly colored, the median cells nearly opaque, the strongly sclerotic partition walls apparently somewhat

<sup>1</sup> Bot. Jahrb. Engler 34: 529. 1905.

<sup>2</sup> Crypt. Vasc. Quit. 361. 1893.

<sup>3</sup> Mex. Pl. Crypt. 84. 1872.



thicker than the castaneous outer walls). It resembles *P. squamatum* somewhat in leaf shape, but it is a much more rigid plant, with stout, deeply sulcate, divaricately paleaceous stipes and more numerous pinnae, these with conspicuous, rigid, wide-spreading, subcapillary, fulvous scales. It is related also to *P. rosei*, but differs widely in its scales, as also in stature and general appearance. The wide-creeping, branched, woody rhizomes, with numerous prominent knoblike, shallowly cyathiform phyllopodia, are wholly characteristic.

The following specimens of *P. pyrrholepis* are in the U. S. National Herbarium:

MEXICO: Vicinity of Córdoba, Veracruz, *Fink* 74 (4 sheets), 73 in part. Tezonapa, Veracruz, *Orcutt* 3375. Zacuapan, Veracruz, January, 1906, *Purpus* 2166. Orizaba, *Mohr* "20, 30, 32."

**15. *Polypodium rosei* Maxon sp. nov.**

Rhizome creeping, simple or with a few short branches, 2.5 to 5 mm. in diameter, freely radicle beneath, densely paleaceous, the scales 3 to 6 mm. long, 0.6 to 0.9 mm. broad, linear-deltoid, mostly long-attenuate, variable in color, richly castaneous with age, the cells of the basal part mostly small, short or oblong-hexagonal, with thick, highly colored partition walls and hyaline to castaneous outer walls, the lumina open or inclosed; margins with numerous, close, mostly divergent, cylindrical teeth, these averaging about 0.13 mm. long, cleft half their length or less. Fronds several, ascending, 15 to 30 cm. long, arising 0.5 to 3 cm. apart, densely paleaceous throughout; stipes 2.5 to 8 cm. long, arcuate; lamina linear-oblong to linear-oblong, 10 to 25 cm. long, 3.5 to 6 cm. broad, subpinnatisect, acute, caudate, rather abruptly narrowed in the basal third (the 1 to 3 lowermost pairs of segments 0.5 to 2 cm. long) or not at all reduced; segments 15 to 20 pairs, their own width apart or more, spreading, mostly 2 to 3 cm. long, 3 to 5 mm. broad, linear, acute, widely dilatate (sometimes bearing a minute distal auricle), connected by a narrow wing, the sinuses broad, rounded-obtuse; scales of the lower surface of segments very dense, widely imbricate, buff to reddish brown in mass, dark-centered, 1 to 2.5 mm. long, deltoid-ovate and acuminate-attenuate or rounded and rather abruptly subulate, the basal portion bearing numerous, very long, closely set, divergent, slender, deeply once cleft teeth, similar but shorter and oblique teeth borne also toward the apex; scales of the upper side whitish, fewer, smaller, nearly capillary, with long spreading teeth; venation concealed, goniophleboid, a single row of 7 to 13 angular-oval areoles extending more than halfway to the margin, the excurrent veinlets free or partly joined in a minor series; sori 6 to 12 pairs, small, slightly inframedial, superficial, terminal upon the short simple included veinlets, evident at maturity. Leaf tissue yellowish green above, rigidly herbaceous.

Type in the U. S. National Herbarium, no. 450839, collected from cliffs of the Sierra de Tepostlán, State of Morelos, Mexico, September 21, 1903, by J. N. Rose and Joseph H. Painter (no. 7254).

Scarcely to be confused with any other species of Mexico, unless perhaps with small specimens of *P. pyrrholepis*, from which it differs widely in its rhizome scales, these (though variable) being flaccid, imbricate, and distinctly linear-deltoid; whereas those of *P. pyrrholepis* are rigidly divergent and almost capillary, being abruptly attenuate-acicular from a small rounded or subovate base. The scales of the lamina show differences almost equally great.

*Polypodium rosei* is not very unlike small plants of *P. squamatum* in leaf form, but it differs very plainly in most of the minute characters, notably in scale shape and structure, and in having superficial rather than impressed sori. *P. squamatum* is wholly West Indian.



The following additional specimens of *P. rosei* are in the U. S. National Herbarium:

MEXICO: Near El Parque, Morelos, *Rose & Rose* 11117. Hills near Guadalajara, Jalisco, on ledges and trees, *Pringle* 4535 (2 sheets).

**16. *Polypodium squamatum* L. Sp. Pl. 1086. 1753.**

*Marginaria squamata* Presl, Tent. Pter. 188. 1836.

*Goniophlebium squamatum* Moore, Ind. Fil. 391. 1862.

*Drynaria squamata* Fée, Mém. Foug. 11: 72. 1866.

*Pleopeltis squamata* J. Smith, Hist. Fil. 114. 1875.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Jamaica and Porto Rico, ascending to 1,600 meters.

ILLUSTRATION: Plum. Trait. Foug. pl. 79.

*Polypodium squamatum* was founded by Linnæus upon the "*Polypodium longifolium, squamulis argenteis*" of Petiver. Petiver's illustration (pl. 7. f. 11) is obviously redrawn from Plumier's plate 79, depicting in exaggerated form a Jamaican plant. Authors from that time to the present have included in their concept of *P. squamatum* several different species from the American mainland (Christensen's Index, for example, giving the range "Ind. occ. Mexico-Peru"), although material at hand shows clearly that this is a species confined to the West Indies. The "*P. squamatum*" of Mettenius<sup>1</sup> is problematical; that of Liebmann is, at least in part, *P. sanctae-rosae*.

The most dependable character of *P. squamatum*, leaving out of consideration the unmistakable and distinctive facies of the plant, lies in the form and color of its rhizome scales. These are 3 to 4 mm. long; the basal third is broadly ovate, the apical two-thirds long-acuminate and very gradually attenuate to a hairlike point. Only the extreme lacerate-fimbriate border of the scale is pale and transparent, the entire median portion being dark reddish-castaneous. The partition walls of the median cells are, apparently, no thicker than in several related species; but both they and the outer walls are so richly colored that the lumina are nearly or quite obscured. The castaneous scale thus appears to have a darker, broad, median band nearly throughout. The rhizome scales of *P. pyrrholepis* also are highly colored, but they are smaller and of very different shape, being more abruptly attenuate from a roundish base. The lamina scales of the two species also are widely different, as explained under *P. pyrrholepis*.

Jenman attempted to distinguish two forms in Jamaica, under the names *P. squamatum* and *P. lepidopteris*, upon the basis of texture, dwarfing of basal segments, and color of lamina scales; but these must needs be variable characters in a plant extending from the lowlands to 1,600 meters altitude, occurring indiscriminately on exposed banks and ledges and upon rotten branches of forest trees; and the whole series of specimens here cited is believed to represent but a single variable species. The resemblance of any of them to the Brazilian *P. lepidopteris* must be called remote; it is true that 1 to 4 pairs of lower pinæ are vestigial, but this change is abrupt, the lamina never being gradually long-attenuate to the base.

The following specimens are in the U. S. National Herbarium:

JAMAICA: Mount Airy, *Maxon* 853. Chestervale, *Underwood* 3269. Near Cinchona, alt. 1,500 meters, *Underwood* 3113. Above Abbey Green, on trail to Blue Mountain Peak, *Maxon* 1395. Vicinity of Hollymount, Mount Diabolo, alt. 750 meters, *Maxon* 2300. Near Mandeville, alt. 600

<sup>1</sup> Abh. Senckenb. Ges. Frankfurt 2: 70. 1856.



meters, *Maxon* 2585. Vicinity of Troy, alt. 600 to 660 meters, *Maxon* 2937; *Underwood* 2932, 2964, 3312. Without exact locality, *Hart* 52, 122a.

PORTO RICO: Near Adjuntas, *Sintenis* 4068, 4282. Las Mesas, near Mayagüez, alt. 350 meters, *Holm* 249a. Without locality, *H. T. Cowles* 257, 273.

**17. *Polypodium fimbriatum* Maxon, nom. nov.**

*Polypodium villosum* Karst. Fl. Columb. 2: 87. 1865-69, not L. 1753, Dulac, 1867, nor Fée, 1872-73.

TYPE LOCALITY: "Valador de Fuquene," Cordillera of Bogotá, Colombia, altitude 2,900 meters.

DISTRIBUTION: Mountains of Colombia.

ILLUSTRATION: Karst. op. cit. pl. 144. f. 1-7 (as *P. villosum*).

Known to the writer only from the Lehmann specimen cited below, listed by Hieronymus<sup>1</sup> as *P. villosum*. This is only about half the size indicated by Karsten's large illustration, but in its minute morphology it agrees absolutely with the excellent detailed figures. Unfortunately the name *Polypodium villosum* is invalid because of its earlier use for the large tropical American species now known as *Dryopteris villosa* (L.) Kuntze. The above new name, *P. fimbriatum*, is therefore suggested.

Mettenius<sup>2</sup> cites two additional Colombian localities for this species, and Christensen ascribes it also to Venezuela and Peru. Lehmann's specimen, above mentioned, is:

COLOMBIA: Near Facatativa, Province of Cundinamarca, alt. 2,600 meters, on sandstone rocks, *Lehmann* 2456.

DOUBTFUL SPECIES.

**1. *POLYPODIUM LANOSUM* Fée, Gen. Fil. 237. 1852.**

According to Christensen's Index Filicum, Fée's *Polypodium lanosum*, described from Chile, is referable to *P. lepidopteris* var. *rufulum*. If it should prove to be distinct and not to have been described under some other name since 1852, it must be renamed, on account of the earlier *Polypodium lanosum* Polr. (1804), applied to other plants.

**2. *POLYPODIUM LONGICAULE* (Fée) C. Chr. Ind. Fil. 326. 1905.**

Judging from description this species, published originally as *Goniophlebium longicaule* Fée,<sup>3</sup> is of the *P. squamatum* group. It does not appear to have been mentioned by recent authors and is wholly unknown to the writer. The original specimens are from Río Hacha, Colombia, *Schlim* 847, and the species is ascribed only to Colombia.

**3. *POLYPODIUM VEXILLARE* Christ in Schwacke, Pl. Nov. Mineiras 2: 21. 1900; Bull. Herb. Boiss. II. 2: 373. 1902.**

Founded upon specimens collected by F. Müller in Santa Catharina, Brazil. Though given a binary name it is described by Christ as a subspecies of *P. lepidopteris*, having the "general aspect of *P. moniliforme* or of very small *P. furfuraceum*." It was collected also by Ule in the same region. Not seen by the writer.

<sup>1</sup> Bot. Jahrb. Engler 34: 530. 1905.

<sup>2</sup> Ann. Sci. Nat. V. Bot. 2: 254. 1864.

<sup>3</sup> Mém. Foug. 8: 95. 1857.



## NEW SPECIES OF POLYPODIUM.

In continuation of a study of the tropical American species of *Polypodium* the five species here described are among those recognized as new. The first four belong to the subgenus *Eupolypodium*, one being allied to *P. pendulum* Swartz, one to *P. subsessile* Baker, and two to *P. capillare* Desv., as that species is currently understood; while the remaining species is of the subgenus *Phymatodes* and allied to *P. lycopodioides* L.

***Polypodium flexuosum* Maxon, sp. nov.**

PLATE 42.

Plants epiphytic, the several fronds pendent, fasciculate, 10 to 15 cm. long. Rhizome decumbent, less than 1 cm. long, 2 to 3 mm. in diameter, densely paleaceous, the scales brownish castaneous in mass, 1 to 1.7 mm. long, linear-deltoid or nearly linear from a rounded base, about 0.3 mm. broad, semitranslucent (the partition cell walls darker visually than the yellowish or yellowish brown outer walls), long-ciliate throughout, the cilia divergent, nearly straight, acicular, unicellular, yellow, 0.2 to 0.4 mm. long; stipe slender, 1 to 2 cm. long, 0.3 to 0.5 mm. in diameter, light brown, dull, scantily long-pilose; lamina 9 to 14 cm. long, 1 to 1.7 cm. broad, linear, arcuate, attenuate in both directions, alternately pinnatifid nearly to the slender blackish flexuous elevated rachis, the sinuses very wide, rounded; segments 15 to 25 on each side, exactly alternate, slightly oblique, 5 to 9 mm. long, 2.5 to 3 (3.5) mm. broad at the middle, oblong or mostly triangular-oblong from a broadly dilatate base (this 4 to 10 mm. broad), obtuse, both leaf surfaces bearing short multicellular simple or branched hairs, the upper surface hirsute also with long, stiff, unicellular hairs, both kinds extending to the margins, the segments ciliate; lower 3 or 4 segments on each side gradually shorter, the basal ones slight; midveins slender, subflexuous, parallel to the proximal margin; veins 3 or 4 pairs, arising at an angle of 50° to 60°, simple, ending in minute hydathodes far from the margin; sori 2 to 4 pairs, small, distant, superficial, supramedial or subterminal, the vein not geniculate; sporangia rigidly long-setose, the setae yellowish brown, 0.13 to 0.2 mm. long; annulus 14 or 15-celled. Leaf tissue pale dull green, quickly discolored, membrano-herbaceous, the veins not readily visible by transmitted light.

Type in the U. S. National Herbarium, no. 657904, collected at Camp La Gloria, south of Sierra Moa, Oriente, Cuba, December 24 to 30, 1910, by J. A. Shafer (no. 8037).

In habit and leaf outline *Polypodium flexuosum* closely resembles *P. pendulum* Swartz, of Jamaica and the Lesser Antilles, and this species alone. *Polypodium pendulum* is, moreover, its closest relative, but differs very definitely in its much larger, distinctly clathrate, shorter-ciliate rhizome scales, its non-hirsute, nonciliate segments, its more numerous veins, its somewhat impressed medial sori, and its bright green leaf tissue.

EXPLANATION OF PLATE 42.—A part of the type specimens of *Polypodium flexuosum*. Natural size.

***Polypodium chiricanum* Maxon, sp. nov.**

PLATE 43.

Plants epiphytic, the fronds (4 to 8) depending obliquely, subfasciculate, 15 to 25 cm. long. Rhizome decumbent, curved, about 3 cm. long, 4 mm. in diameter, obscurely paleaceous at the apex, the scales brownish, 1.9 to 3 mm. long, 0.45 to 0.75 mm. broad (excluding cilia), lanceolate to ovate from a cordate base, acute to attenuate, 12 to 22 cells broad (the partition cell



walls reddish brown, moderately sclerotic, the outer cell walls hyaline or lutescent), copiously ciliate (chiefly above the middle), the cilia 0.15 to 0.3 mm. long, bristle-like, hyaline; stipe 1.5 to 2.5 cm. long, 0.8 mm. in diameter, pale brown, terete, minutely pubescent; lamina 14 to 24 cm. long, 8 to 12 cm. broad, oblong, acutish at the apex, essentially pinnate, very abruptly expanded above the base, the extreme basal portion consisting of a few alternate sinuately joined lobes or low crenations; rachis slender, blackish, slightly elevated, subflexuous toward the apex, glabrescent; principal segments 15 to 17 pairs, spreading ( $70^\circ$ ), alternate, mostly straight, 4 to 6.5 cm. long, 3 to 5 mm. broad, linear-attenuate, acutish, lightly sinuate, slightly dilatate above, strongly so below, 10 to 11 mm. broad at the rachis, the segments here contiguous but scarcely at all connected (the sinus wide, inequilateral, obliquely acutish), elsewhere 1 to 3 times their width apart; midvein subflexuous, nearly immersed; veins 12 to 22 pairs, arising at an angle of about  $40^\circ$ , simple, the sterile ones straight, the fertile ones sharply geniculate nearly at a right angle from the proximal side of the protruding receptacle; sori 7 to 14 pairs, slightly supramedial in attachment, deeply impressed, apart, equidistant from the midvein and margin; sporangia glabrous, the annulus 12-celled. Leaf tissue dark green, glabrous, rigidly subspongiose-herbaceous, semitranslucent, pustulate over the sori.

Type in the U. S. National Herbarium, no. 675858, collected from a tree trunk in humid forest between Alto de las Palmas and top of Cerro de la Horqueta, Chiriquí, Panama, altitude 2,100 to 2,268 meters, March 18, 1911, by William R. Maxon (no. 5478).

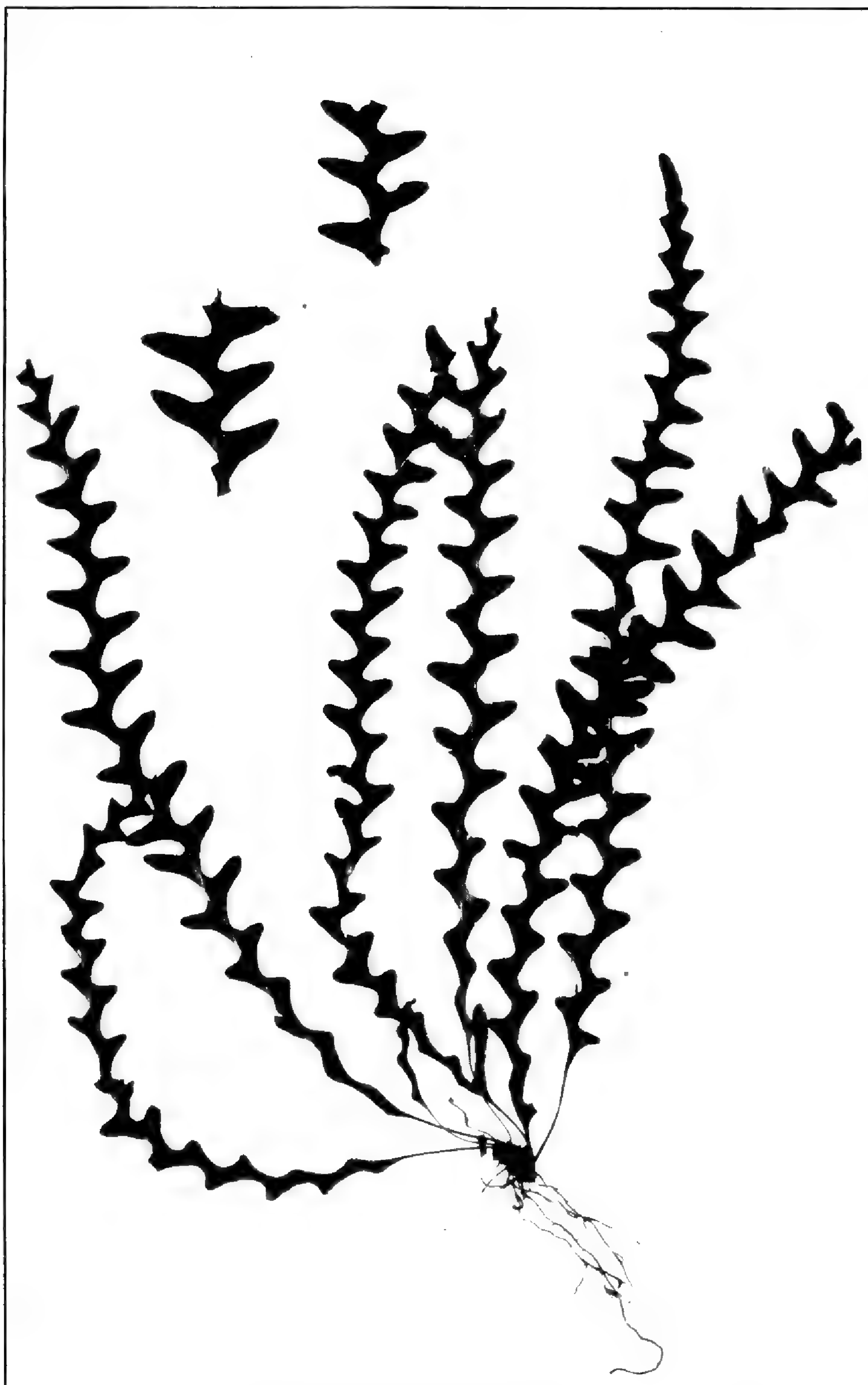
*Polypodium chiricanum*, which is known only from the type specimen, is a near ally of *P. subsessile* Baker, differing from that species especially in its greater size, its broader, scarcely clathrate, longer-ciliate rhizome scales (these brownish and not at all grayish in mass), its longer, broader, and strongly decurrent (not subequally dilatate) segments, nearly immersed midveins, and more acutely divergent veins.

EXPLANATION OF PLATE 43.—Type specimen of *Polypodium chiricanum*. Scale  $\frac{1}{2}$ .

***Polypodium crassulum* Maxon, sp. nov.**

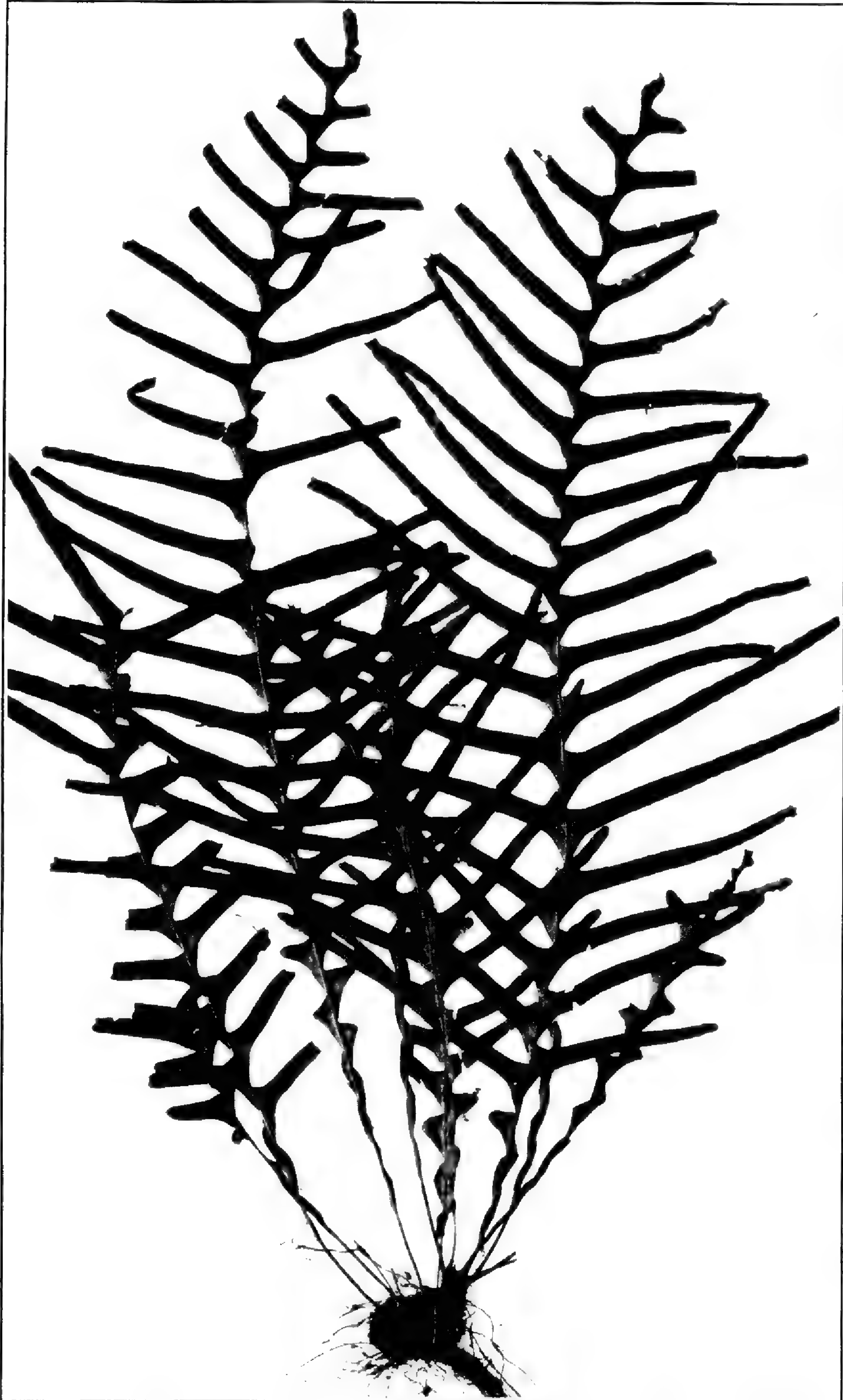
Plants epiphytic, the fronds pendent, several to very numerous, imbricate-fasciculate, long-persistent, 20 to 40 cm. long. Rhizome stout, erect, 2 to 5 cm. long, nearly 1 cm. in diameter, copiously and coarsely radicate, only the apex paleaceous, the scales concealed, reddish brown in mass, 2 to 3 mm. long, 0.15 to 0.25 mm. broad, linear, entire, semitranslucent, yellowish brown singly, concolorous, both outer and partition cell walls thin; stipe 1 to 5 cm. long, subterete, gradually flattish above, very copiously tomentose-pilose, the close-set spreading hairs reddish brown, very slender, 3 to 5 mm. long; lamina 18 to 38 cm. long, 5 to 8 cm. broad, linear, acuminate at the apex, acute at the base, subpinnate, often more or less irregular in outline from the abortion of the apex and of the segments; rachis flexuous, wholly immersed; segments 20 to 50 pairs, oblique ( $60^\circ$ ), 3 to 8 cm. long, 2 to 2.5 mm. broad, linear, long-attenuate, entire or slightly sinuate, fully adnate but not surcurrent, long-decurrent and faintly connected, elsewhere 1 to 3 times their width apart; segments sometimes once or twice dichotomous in their outer part; midvein immersed, medial, decurved at the base; veins 10 to 20 pairs, immersed, borne at an angle of  $10^\circ$  to  $30^\circ$ , simple or mostly once forked, the proximal branch greatly extended; sori rather few and intermittent, 3 to 8 pairs, nearly superficial, terminal upon the vein or at the clavate end of the proximal branch, touching or exceeding the margin, paraphysate; sporangia glabrous, the annulus 11 or 12-celled. Leaf tissue rig-





POLYPODIUM FLEXUOSUM MAXON.





POLYPODIUM CHIRICANUM MAXON.



idly herbaceous, slightly translucent, nearly glabrous above, beneath bearing a few fuscous 2 to 5-celled glandular hairs, these 0.13 to 0.2 mm. long.

Type in the U. S. National Herbarium, no. 600742, collected at Tablazo, Costa Rica, altitude 1,900 meters, March 4, 1908, by C. Brade; received under the name *P. capillare* Desv. Two additional specimens are at hand, both collected in Costa Rica by Wercklé. Of these only one (distributed by Jiménez as no. 588) bears precise locality data; namely, San Jerónimo, altitude 1,500 meters.

*Polypodium crassulum* is clearly related to *P. capillare*, but more closely to *P. pilipes* Hook., of the Peruvian Andes, from which, as illustrated, it differs in its entire or faintly undulate, mostly simple segments. It is a rigidly herbaceous plant and of harsh texture in drying, a circumstance which has suggested the specific name employed.

*Polypodium nubigenum* Maxon, sp. nov.

Plants usually epiphytic, the fronds pendent or prostrate, numerous, fasciculate, 10 to 25 cm. long. Rhizome erect or oblique, 1 to 3 cm. long, about 4 to 7 mm. in diameter, freely radicose throughout, densely but inconspicuously paleaceous, the scales dark glossy brown in mass, nearly acicular, 1.8 to 3 mm. long, 0.1 to 0.2 mm. broad, subflexuous toward the tip, distantly erose-denticulate, sparingly long-ciliate (the cilia divergent, acicular, hyaline, fragile, mostly 0.08 to 0.17 mm. long, sometimes shorter and glandlike), castaneous by transmitted light, semitranslucent, the cells narrowly oblong to linear, both partition and outer walls thin but highly colored; stipes 1 to 2 cm. long, 0.3 to 0.4 mm. in diameter, densely pilose with long spreading reddish hairs; lamina very nearly pinnate, 9 to 23 cm. long, 1 to 6 cm. broad, linear, acutish at both ends; rachis slender, blackish and raised below, bearing a few scattering but persistent stiffish hairs like those of the stipe, also, together with both surfaces of the lamina throughout, copiously glandular-pulverulent, the hairs minute, consisting of 2 to 4 spherical whitish beadlike cells; segments unequal, numerous, spreading (averaging  $70^\circ$ ), alternate, straight or subflexuous, 0.5 to 5 cm. long, 2 to 3 mm. broad, linear, usually attenuate and acutish, strongly sinuate, slightly decurved and decurrent at the fully adnate base (here 3 to 4 mm. broad), the segments rather close, faintly connected, the sinuses narrow, acutish; midveins subflexuous, mostly concealed; veins 3 to 18 pairs, very oblique ( $20$  to  $30^\circ$ ), simple (or the basal ones forked), slightly curved, extending halfway to the margin; sori 2 to 17 pairs, terminal, superficial, not confluent, extending to or at maturity slightly beyond the margin; sporangia glabrous, the annulus usually 12-celled. Leaf tissue subspongiose-herbaceous, the veins not wholly evident by transmitted light.

Type in the U. S. National Herbarium, no. 427732, collected at the summit of Blue Mountain Peak, Jamaica, altitude 2,220 meters, April 20 or 21, 1903, by William R. Maxon (no. 1477).

The present species is known only from the highest peaks of the Blue Mountains, Jamaica, where it is locally abundant. It was described by Jenman<sup>1</sup> as "*Polypodium capillare* Desv.," but represents a form specifically distinct from the several others which are so referred by various writers. *Polypodium capillare* is, in fact, a very poorly understood species, described originally from the "Antilles," but since assigned a wide tropical American range. The original description is brief and may be said to apply indifferently to several forms. There is, however, slight probability of its having been founded on the isolated plant of Blue Mountain Peak, here described as *P. nubigenum*.

*Polypodium nubigenum* is most closely related to *P. graveolens* Baker, an endemic Jamaican plant of lower altitude, which it resembles closely in most

<sup>1</sup> Bull. Bot. Dept. Jamaica II. 4: 120. 1897.



gross characters. It differs constantly from that, however, in its very much narrower rhizome scales, more slender stipes, sparingly but persistently pilose rachises, slightly broader segments, acutish sinuses, and mostly simple veins.

It is possible that *P. graveolens* Baker represents the true *P. capillare* Desv. This and the status of *P. decipiens* Hook. will be discussed later.

***Polypodium palmeri* Maxon, sp. nov.**

Rhizome funiform, wide-creeping, stout (3 to 5 mm. in diameter), usually not much branched but with numerous short innovations, densely paleaceous, the scales lance-linear, long-attenuate, 6 to 8 mm. long, widely imbricate, appressed, attached far above the base, the central basal portion ferruginous, the borders and slender tips whitish and fragile, the scales thus broken and darker with age. Fronds numerous, subdimorphous, the sterile ones 5 to 20 cm. long, 2 to 4 cm. broad, very variable in shape, oblong, linear-oblong, or lanceolate, nearly exstipitate, cuneate at the base, the apices broadly rounded to acute, the extremes occurring in the same plant; fertile fronds 8 to 18 cm. long, 0.8 to 2.5 cm. broad, linear, linear-oblong, or rarely lanceolate, acute or rarely obtuse, exstipitate, narrowly cuneate; leaf tissue rigidly chartaceous, more or less translucent, glabrous or at first slightly fibrillose beneath along the slender costa; venation variable, commonly evident beneath, the costal areoles very small, parallel to the costa; paracostal areoles large, obliquely transverse, extending more than half way to the margin, broadly oblong, usually subdivided into several diverse minor areoles, these with or without free veinlets; 1 or usually 2 rows of small areoles borne between the paracostal row and the margin, these small, with recurved veinlets; sori uniserial, large, 15 to 30 pairs, extending usually from base to apex, nearly medial, lightly impressed, borne only in the paracostal areoles, usually toward their distal end.

Type in the U. S. National Herbarium, no. 572544, collected from specimens climbing 2 to 3 meters high upon trees in a rocky forest near Gómez Fárías, State of Tamaulipas, Mexico, altitude about 350 meters, April 13 to 21, 1907, by Dr. Edward Palmer (no. 308); distributed as *Phymatodes palmeri* sp. nov.

Probably not a rare species; in the past not unnaturally confused with *P. lycopodioides*, its nearest North American ally, which occurs throughout the West Indies and on the continent from Guatemala to Panama. From that species *P. palmeri* differs in its much thicker and heavier, ropelike rhizomes and its very large sterile fronds, which are of different shape. The extremes of leaf shape include those of *P. lycopodioides*, but that is a smaller plant of very different facies. The very thick, whitish-scaly rhizomes of *P. palmeri* are especially characteristic.

Besides the type, the following specimens, most of which are stated to have grown on tree trunks, are in the U. S. National Herbarium:

MEXICO: Antigua, *Liebmann*. Curahuesco, Tabasco, *Roviroso* 210. Zacuapan, State of Veracruz, December, 1906, *Purpus* 2164. Near Tampico, Tamaulipas, alt. 15 meters, June, 1910, *Palmer* 508. Coatzacoalcos, Isthmus of Tehuantepec, State of Veracruz, *C. L. Smith* 2108. Orizaba, *J. G. Smith* 85; *Mohr*. Limestone hills of Las Palmas, State of San Luis Potosí, *Pringle* 3355. Sanborn, State of Veracruz, *Orcutt* 3389. Chichen Itzá, Yucatán, *C. & E. Seler* 5573. Izamal, Yucatán, *Gaumer* 528.

HONDURAS: San Pedro Sula, Department of Santa Bárbara, alt. 300 meters, *Thieme* (J. D. Smith, no. 5688). Near Highland Creek, Puerto Sierra, *Wilson* 81.

NICARAGUA: Greytown, *Wright*; *C. L. Smith*, 2044.

PANAMA: Chagres, *Fendler* 395.



## NOTES ON NOTHOLAENA.

The following notes relate to several species of *Notholaena* which have been generally misunderstood or misidentified in recent years. There are included, incidentally, descriptions of two new species.

*Notholaena cretacea* Liebm. Dansk. Vid. Selsk. Skrivt. V. 1: 216. 1849.

It has been customary to regard *Notholaena cretacea* as a species of relatively wide distribution, extending from Puebla, the type locality, northwestward to Arizona, California, and Lower California. Its characters have not as a rule been sharply drawn, having been regarded conveniently as those of a polymorphic species, or else it has been redescribed on the basis of the well known plant of southern California, which was described long ago by Eaton as a distinct species, *Notholaena californica*, but subsequently reduced to *N. cretacea*. In reality Eaton's species is well founded, and it is equally clear that a third species, intermediate in range, must be recognized. This has been variously determined as *Notholaena cretacea*, *N. californica*, *N. candida*, and *N. schaffneri*. No published name being available it is here described as a new species, *Notholaena neglecta*, and comparative notes upon the several species mentioned are given.

*Notholaena cretacea* was founded upon specimens collected from clefts of limestone cliffs in the vicinity of Tehuacán, State of Puebla, altitude about 5,400 ft. by Liebmann, no other localities being mentioned. The description, like most of Liebmann's, is excellent, and, so far as it goes, applies perfectly to a plant of the type collection received from Copenhagen through the courtesy of Mr. Carl Christensen. This in turn agrees with a more completely fertile specimen collected at the same locality in 1906 by Dr. J. N. Rose (no. 11384). A better development of the species is seen, however, in two Puebla specimens collected by Purpus (3145, 4028), these being larger and more robust and having the laminae slightly more divided.

These four numbers taken together show *N. cretacea* to differ constantly from the plant of northern Mexico and southern Arizona, *N. neglecta*, in several important characters. The rhizome scales are larger (3.5 to 4.5 mm. long) and much darker in the broad median area, and have the narrow translucent margins minutely denticulate, the teeth tipped with short, capitate, glandular prominences; the lamina is relatively broader, not at all elongate toward the apex, less compound, and more freely pulverulent above; the pinnae are fewer and pinnatifid to the extreme tip, thus lacking the conform or elongate, entire terminal segment which is characteristic of *N. neglecta*; and the segments are relatively flat and close, the sporangia from the closely revolute margin never concealing the dense, pale yellowish, ceraceous covering of the lower surface. The points of distinction from *N. californica* are stated under that species.

The specimens of *N. cretacea* above mentioned are:

PUEBLA: Vicinity of Tehuacán, alt. about 1,620 meters, *Liebmann* (type collection). Same locality, *Rose* 11384. Vicinity of San Luis Tultitlanapa, June, 1908, *Purpus* 3145. Tlacuiloltepec, alt. 1,800 to 2,100 meters, July, 1909, *Purpus* 4028.

The two *Purpus* numbers were distributed as *N. candida* (Mart. & Gal.) Hook., from which species they differ widely in their narrow and inconspicuously bicolorous scales, as also in the size, outline, and dissection of the lamina.



**Notholaena neglecta** Maxon, sp. nov.

Plants fasciculate, the fronds numerous, erect or ascending, 3 to 20 cm. high. Rhizomes large, multicipital, the numerous branches short (0.5 to 2 cm. long), decumbent, 3 to 5 mm. in diameter, very densely paleaceous, copiously radicate beneath; scales imbricate, closely impacted, 3 to 3.5 mm. long, 0.5 to 0.7 mm. broad near the base, linear-lanceolate, long-attenuate to a subflexuous apex, bicolorous (usually sharply so), the narrow, dark brown, sclerotic median stripe percurrent, opaque, the cells linear, minute, indistinct; borders as broad as the dark median area or slightly narrower, delicate, pale yellowish or usually whitish and transparent, irregularly denticulate, the teeth hyaline. Fronds close, apparently distichous, usually long-stipitate; stipes 1 to 16 cm. long, slender (0.4 to 0.7 mm. thick), terete, black, sublustrous, with a few deciduous scales toward the base; lamina nonpaleaceous, elongate-pentagonal, acuminate, 2.5 to 8.5 cm. long, 2 to 6.5 cm. broad, tripinnate to quadripinnate in the basal half, simpler above, the apex usually produced, finally pinnatisect; rachis similar to the stipe but slightly sulcate ventrally; basal pinnae much the largest, sessile, deltoid, acuminate, inequilateral, basisropic, the lowermost of the inferior pinnules greatly produced, the others gradually shorter and simpler; second pair of pinnae shorter, elongate-deltoid, inequilateral, basisropic, sometimes rather strongly so; other pinnae simpler, contiguous, narrowly deltoid-oblong to oblong, usually (except in the largest specimens) once pinnate, the segments oblique, mostly simple, narrowly oblong from a slightly broader, subcordate, inequilateral base, obtuse or acutish, subsessile or semiadnate, the base slightly overlying the slender secondary rachis; terminal segments of pinnae and pinnules conform or slightly produced, entire; segments in general similar, or the lateral ones of the basal pinnae sometimes short and rounded, all the segments deeply concave, apart, rigidly herbaceo-coriaceous, tight grayish green and slightly pulverulent above (the granules few, distant, subpersistent), beneath densely pulverulo-ceraceous, the powder very pale ochroleucous, nearly or quite concealed at maturity by the very numerous brown sporangia thrust far inward by the widely concave margins; spores globose, about 50  $\mu$  in diameter, minutely roughened.

Type in the U. S. National Herbarium, no. 397878, collected among rocks on the dry, sloping sides of a canyon near Saltillo, State of Coahuila, Mexico, November 10 to 20, 1902, by Dr. Edward Palmer (no. 324).

The following additional specimens are in the National Herbarium:

COAHUILA: Sierra Mojada, April 19, 1892, *Jones* 520; same locality and date, *Jones* (2 specimens without number). San Lorenzo Canyon, 6 miles southeast of Saltillo, September 21 to 23, 1904, *Palmer* 424.

CHIHUAHUA: Limestone cliffs, Santa Eulalia Mountains, September 9, 1885, *Pringle* 452 (2 sheets).

ARIZONA: Huachuca Mountains, August, 1882, *Lemmon* (2 sheets). Mule Mountains, Cochise County, on exposed south face of limestone cliffs, January 1, 1913, *Goodding* 1384.

The collection selected as the type includes the largest specimens seen, these apparently representing the maximum development of the species. In several of them the lamina is truly quadripinnate at the base and the stipes are extreme in length, the latter condition probably arising from the fact that the plant grew among loose rocks. In most of the other collections the stipes are shorter and the laminae smaller and simpler, usually tripinnate at the base. The Arizona and Chihuahua specimens average considerably smaller, but evidently are different in no characters not dependent upon their lesser size. The Lemmon specimens are in all probability the Arizona element included by Eaton in his description of *Notholaena californica*.



From *Notholaena cretacea*, as restricted above, *N. neglecta* differs in the characters already mentioned. It is compared with *N. californica* in the notes under the latter species.

***Notholaena californica*** D. C. Eaton, Bull. Torrey Club 10: 27. 1883.

This species was at first confused with *Notholaena candida* by Eaton as "the California form of that species," but was subsequently described by him as new under the above name, the description being based chiefly upon specimens from San Diego County, California, but including characters derived from Arizona specimens collected by Lemmon. The choice of specific name, the greater amount of California material studied, and the above quoted phrase are sufficient to fix the California plant as the typical element of Eaton's species. Lemmon's Arizona specimens in the National Herbarium are a rather small state of *N. neglecta* and those in the Eaton Herbarium are doubtless of the same species.

The copious material at hand indicates that *N. californica* is a well-marked species, differing from *N. cretacea* in its far lesser size and its more distant, shorter, and more rounded segments; from *N. neglecta* in its broadly pentagonal (never elongate) lamina and its relatively broad, rounded-obtuse segments; and from both species obviously in its brown to light castaneous (never blackish) stipes and rachises and in the peculiar character of its rhizome scales. The scales are rigidly subacicular, straight or usually curved, 3.5 to 4.5 mm. long, 0.17 to 0.26 broad in the basal part, long-attenuate to the filiform subflexuous tip, nearly concolorous, dark reddish brown, opaque, with only the marginal row of cells in the middle and lower part of the scale pale, this consisting mainly of numerous spreading, unicellular, hyaline teeth, the teeth in the apical part of the scale slender, longer (up to 0.15 mm. long), mostly curved (often retrorsely), rigid, hyaline or commonly reddish brown and sclerotic.

There is noted a good deal of variation in the color and the degree of development of the ceraceous covering of the lamina, some of the specimens being densely glandular or glandular-viscid beneath and nearly or quite devoid of the usual yellowish ceraceous covering. These have sometimes been referred to as "the white powdered form." Their status and relationship are not altogether clear, but the variations observed are probably well within the species limits and may be correlated with local or seasonal conditions. It is possibly this form which was designated by Prantl<sup>1</sup> as a new species, *N. albida*, but never described.

The following specimens of *N. californica* are in the National Herbarium:

CALIFORNIA: Slover Mountain, near Colton, April, 1886, S. B. & W. F. Parish; May, 1894, S. B. Parish; May 4, 1901, S. B. Parish 4739. San Bernardino, W. B. Wright. Near Colton, May, 1882, Jones. Agua Caliente, desert slope of San Jacinto Mountain, April, 1884, S. B. & W. F. Parish 502A; April, 1886, S. B. & W. F. Parish 502. Andreas and Murray Canyons, Palm Springs (eastern slope of San Jacinto Mountain), August 23, 1906, Kearney. Spring Valley, San Diego County, Laura F. Kimball 21. Mountain Spring, San Diego County, May 12, 1894, Schoenfeldt 3078. San Diego County, G. R. Vasey 691. Avalon, Santa Catalina Island, February, 1897, and March, 1889, Blanche Trask. Without definite locality, Parry & Lemmon 429.

ARIZONA: Hills 4 miles northwest of Congress Junction, altitude 750 to 900 meters, February 17, 1912, Wootton.

<sup>1</sup> Bot. Jahrb. Engler 3: 405. 1882.



LOWER CALIFORNIA: San Telmo, April 17, 1886, *Orcutt* 1461. Los Angeles Bay, Gulf of California, 1887, *Palmer* 552. Ensenada, January 25, 1889, *Orcutt*. Santa Margarita Island, March 3, 1899, *Brandege*. Cedros Island, March 18 to 20, 1889, *Palmer* 748.

The known ranges of the three species just discussed are entirely natural. *Notholaena cretacea* is apparently confined to the southerly region of Puebla; *N. neglecta* is found chiefly in the northern parts of Mexico, barely entering the United States in extreme southeastern Arizona; *N. californica* occupies the region of California and Lower California, the single Arizona station being close to the southern California localities and of very similar character, and remote from the Arizona localities for *N. neglecta*.

***Notholaena schaffneri*** (Fourn.) Underw.; Davenp. Gard. & For. 4: 519. 1891.

*Aleuritopteris schaffneri* Fourn. Bull. Soc. Bot. France 27: 328. 1880.

*Notholaena nealleyi* Seaton, Contr. U. S. Nat. Herb. 1: 61. 1890.

*Notholaena nealleyi* var. *mexicana* Davenp. Bot. Gaz. 16: 54. 1891.

*Notholaena schaffneri* var. *mexicana* Davenp. Gard. & For. 4: 519. 1891.

Although *Notholaena schaffneri* is not at all of close relationship to any of the foregoing species, specimens of *N. neglecta* have nevertheless been so named and distributed in at least one instance (Sierra Mojada, *Jones*). On this account and also because the excellent distinctive characters of *N. schaffneri* have been very generally overlooked, it seems desirable to include a re-description of this species. A considerable amount of variation in the glandular-ceraceous covering is observed, some of the specimens (notably *Seaton* 894 (560) and *Palmer* 555) having the fronds rather densely covered beneath with separate translucent glands and nearly or quite lacking the usual thick, continuous coating of whitish powder. Pringle's 1864, however, embraces specimens of both types. These differences, which are apparently not wholly due to age, are similar to those mentioned under *N. californica*, above.

Plants 10 to 35 cm. high, with numerous stiffish fasciculate fronds, their vascular parts freely barbate-paleaceous. Rhizome multicapital, the divisions several, stout, aggregated, decumbent or ascending, densely covered with closely impacted scales, these 2.5 to 3.5 mm. long, very slender, long-attenuate and subulate from a slightly broader base, coal-black and opaque (except for a short yellowish brown median stripe at the extreme base), rigid, evenly long-ciliate throughout, the cilia 0.09 to 0.15 mm. long, blackish, rigid, mostly straight, divergent, 15 to 25 on each side; stipes straight or nearly so, 2.5 to 10 cm. long, about 1 mm. in diameter, dark brown to blackish, closely glandular, often deciduously whitish-farinose, bearing numerous rigidly divergent ciliate scales similar to those of the rhizome but reddish brown in color; lamina linear-oblong to linear-oblongate, 7 to 20 cm. long, 2 to 5.5 cm. broad, acuminate, gradually narrowed toward the base, at least bipinnate throughout, the largest fronds subtripinnate; rachises and the midveins of the segments beneath bearing numerous long spreading subulate scales, these only 1 or 2 cells broad, appearing like stiff turgid jointed hairs; pinnae 15 to 25 pairs below the acuminate apex, subopposite to alternate, the lower ones gradually reduced, deltoid, 7 to 15 mm. long, subdistant, those above gradually longer, larger, and closer, mostly 1.5 to 3 cm. long, deltoid-ovate to narrowly oblong, slightly inequilateral, acutish, with about 5 to 9 pairs of subdistant to approximate narrowly oblong segments below the lobate apex; segments sessile and pinnatisect, or mostly semiadnate and pinnately lobed, the lobes (3 or 4 pairs) rounded, adnate, suborbicular, obscurely crenate, or the smaller ones entire; leaf tissue rigidly herbaceous, sparsely but evenly glandular or delicately whitish-ceraceous above, densely so beneath, usually developing a thick white



ceraceous covering; margins slightly revolute, concealed at maturity by the continuous but narrow line of very dark brown sporangia.

The following specimens of *N. schaffneri* are in the National Herbarium:

TEXAS: Limpia Canyon, Presidio County, *Nealley* 894 (560), the type of *N. nealleyi*. Goodenough Spring (near Comstock), Valverde County, October, 1892, *Nealley* 123 (3 sheets).

JALISCO: Dry shaded ledges, barranca near Guadalajara, alt. 1,500 meters, *Pringle* 1864 (2 sheets); *Pringle* 3880 (2 sheets); *Pringle* 11789. Face of large rocks in a canyon at Río Blanco, September 19, 1886, *Palmer* 555 (2 sheets). Bolaños, *Rose* 2910.

ZACATECAS: Near Monte Escobedo, *Rose* 2662.

PUEBLA: Tlacuilotepec, July, 1909, *Purpus* 4029 (ex Mus. Bot. Berol.).

VERACRUZ: Barranca de Santa María, Zacuapan, October, 1912, *Purpus* 6199.

Of these specimens, *Pringle's* 1864 was distributed as *N. grayi* Davenp., and *Palmer's* 555 was so referred by Eaton.<sup>1</sup> *Notholaena schaffneri* is not very closely related to that species, however, differing widely in its black, rigidly long-ciliate rhizome scales and its strongly barbate-paleaceous rachises and midveins, characters described above. The differences in leaf cut and in general appearance are equally pronounced, *Notholaena grayi* having the fronds, rachises, and midveins clothed with numerous lax, tortuous, pale brown, deciduous scales wholly different in color, form, structure, and direction from those of *N. schaffneri*.

The characters and distribution of *N. grayi* were discussed briefly by the writer<sup>2</sup> some time ago with reference to the strict form of this species described, under the invalid name *Notholaena hypoleuca* Goodding,<sup>3</sup> upon specimens collected from Slavonian Canyon, Mule Mountains, Arizona, August, 1911, by Leslie N. Goodding (no. 1004); U. S. Nat. Herb. no. 692687. Of the United States specimens mentioned those collected in Arizona by Lemmon and by G. R. Vasey are the best developed, agreeing closely with Faxon's beautiful illustration of the type.<sup>4</sup>

In studying *Notholaena grayi* the following new species was detected:

***Notholaena aliena* Maxon, sp. nov.**

Plants small, 6 to 13 cm. high, the several fronds slender, long-stipitate, fasciculate. Rhizome (incomplete) small, presumably multicipital, the branches apparently very short, horizontal, thick, densely paleaceous, the scales appressed, 1.5 to 2 mm. long, linear-deltoid, stiff, very dark brown, opaque, conspicuously long-ciliate, the cilia stout, brown, unicellular, curved, irregularly divergent, either antrorsely or retrorsely directed, fragile; stipes 3 to 7 cm. long, about 0.4 mm. in diameter, arcuate, light brown from a darker base, here deciduously paleaceous, the scales nearly capillary; lamina linear to linear-oblong, 4 to 8.5 cm. long, 1 to 1.5 cm. broad, acutish, subbipinnate in the basal part, very deeply bipinnatifid nearly throughout, the pinnæ minutely glandular-ceraceous above and laxly villous with tortuous white hairs, densely yellowish ceraceous beneath, this covering mostly concealed at maturity by numerous pale-brown capillary scales arising from the secondary rachises and the midveins of the segments; pinnæ 8 to 13 pairs, subopposite to alternate, slightly ascending, the lower and middle ones deltoid to deltoid-ovate, acutish, distant, the upper

<sup>1</sup> Proc. Amer. Acad. 22: 463. 1887.

<sup>2</sup> Amer. Fern Journ. 3: 112, 113. 1913.

<sup>3</sup> Muhlenbergia 8: 94. 1912.

<sup>4</sup> Bull. Torrey Club 7: 50. pl. 4. 1880.



ones mostly oblong, narrower, and closer; segments 4 or 5 pairs, mostly approximate, oblong, subfalcate, obtuse, only the basal ones of the larger pinnæ sessile or subsessile, these 3 to 4.5 mm. long, strongly crenate, the other segments entire or sometimes lightly crenate; sori marginal, strongly confluent at maturity in a relatively broad line, covering the concave leaf surface between the midvein and the slightly revolute but unmodified margin, partially concealed by scales.

Type in the U. S. National Herbarium, no. 50929, collected in low mountains about 25 miles southwest of Monclova, State of Coahuila, Mexico, September 9 to 19, 1880, by Dr. Edward Palmer (no. 1389). Additional specimens of the same collection are mounted on sheet no. 834644.

Related to *Notholaena grayi* Davenp., with which it was confused by Eaton,<sup>1</sup> but readily distinguished from that species in having its upper leaf surfaces distinctly villous from the presence of numerous lax, whitish, tortuous hairs, *Notholaena grayi* being sparsely pulverulo-ceraceous above and devoid of any hairy covering whatever. The rhizome scales also are smaller and much more strongly ciliate.

*Notholaena galeottii* Fée, Gen. Fil. 159. 1852.

*Notholaena arsenii* Christ, Not. Syst. 1: 232. 1910.

*Notholaena hyalina* Maxon, Amer. Fern Journ. 5: 4. 1915.

The above synonymy will indicate an error, pointed out by Mr. Carl Christensen in a recent letter, into which both Christ and the writer have fallen in describing independently, as a segregate of *Notholaena aschenborniana*, the plant of southern Mexico long ago described by Fée as *Notholaena galeottii*. Fée's type (Caputalpan, Oaxaca, alt. 3,000 meters, *Galeotti* 6565) has not been seen by the writer; but the description, so far as it goes, seems to apply to *N. hyalina*. Christ's description of Puebla specimens as *N. arsenii* was, unfortunately, overlooked by the writer until the article describing *N. hyalina* was in type. The inaccurate and misleading phrase "pinnis . . . . pagina superiore laevigatis" left some doubt that the plants described by the writer as having the upper surfaces "conspicuously hispid by numerous spreading hyaline simple hairs" could really be the same, although the general agreement of the descriptions was recognized at that time. Christensen has since examined Arsène's specimens and associates them with *Pringle* 3297, the type of *N. hyalina*.

In addition to the specimens of *N. galeottii* previously listed by the writer (as *N. hyalina*) the following are now at hand:

PUEBLA: Near Tehuacán, *Rose, Painter, & Rose* 10126.

GUERRERO: Cañón de la Mano Negra, near Iguala, *Rose, Painter, & Rose* 9392.

The more northerly range of *N. aschenborniana* Klotzsch (*N. bipinnata* Liebm.) has been indicated elsewhere,<sup>2</sup> with citation of specimens.

*Notholaena greggii* (Mett.) Maxon.

*Pellaea greggii* Mett.; Kuhn, Linnaea 36: 86. 1869.

*Notholaena pringlei* Davenp. Bull. Torrey Club 13: 132. pl. 58. 1886.

*Allosorus greggii* Kuntze, Rev. Gen. Pl. 2: 806. 1891.

In describing *Notholaena leonina* several years ago<sup>3</sup> the writer had occasion to consult the original description of *Pellaea greggii* Mett., but at that time was unable to identify the plant described. A recent reading of the description,

<sup>1</sup> Proc. Amer. Acad. 18: 184. 1883.

<sup>2</sup> Amer. Fern Journ. 5: 6, 7. 1915.

<sup>3</sup> Contr. U. S. Nat. Herb. 16: 58. 1912.



however, strongly suggested *N. pringlei*, and subsequent comparison of a specimen of the type collection of *P. greggii* with *N. pringlei* has shown them to be identical in every respect. The specimen referred to, *Gregg* 467, is no. 47866 in the Herbarium of the Missouri Botanical Garden and has the following data: "*Allosorus Greggii* n. sp. 467. Rock-fern. Rocky hill n. west of Mapimí, N. Mexico. Dr. J. Gregg. April 17, 1847." The name is in Mettenius's handwriting. Mapimí is situated in the northern part of the State of Durango, northwest of Lerdo and Torreón. The displacement of the well-known name, *N. pringlei*, given first to Pringle's excellent material, is unfortunate. It is, however, important to place beyond doubt the older species of Mettenius, which apparently has had only nominal recognition, and that under the wrong genus.

The following specimens of *N. greggii* are in the National Herbarium:

DURANGO: El Mundo Hill, near Lerdo, alt. 1,650 meters, *Chaffey* 58 in small part.

CHIHUAHUA: Dry calcareous ledges and bluffs, Santa Eulalia Mountains, April 23, 1885, *Pringle* 441 (4 sheets), the type collection of *N. pringlei*.

COAHUILA: Sierra Mojada, *Jones* 519. San Lorenzo de Laguna and vicinity, 22 to 27 leagues southwest of Parrás, May 1 to 10, 1880, *Palmer* 1382 (2 sheets); *Palmer* 1383 (2 sheets). Mountains 24 miles northwest by north from Monclova, September 1 to 6, 1880, *Palmer* 1384 (2 sheets).

### MISCELLANEOUS NOTES.

***Bommeria ehrenbergiana*** (Klotzsch) Fourn.

An additional collection of this rare species has been received:

MEXICO: Pont de México, near Puebla, December 20, 1908, *Arsène*.

***Coniogramme americana*** Maxon, nom. nov.

*Gymnogramme subcordata* Eaton & Davenp. Contr. U. S. Nat. Herb. 5: 138. pl. 16. 1897.

*Coniogramme subcordata* Maxon, Contr. U. S. Nat. Herb. 17: 174. 1913, not Copel. 1910.

In transferring recently to *Coniogramme* the Mexican plant described originally as *Gymnogramme subcordata* the writer overlooked the fact that the name *Coniogramme subcordata* had already been formed by Copeland for a Philippine plant. The Mexican plant is therefore renamed as above. It is the only American member of the genus *Coniogramme*.

***Danaea crispa*** Endres.

An excellent illustration not mentioned in the North American Flora<sup>1</sup> is plate 1700 of Hooker's *Icones Plantarum*, 1887.

***Lycopodium tubulosum*** Maxon, Contr. U. S. Nat. Herb. 17: 178. 1913.

Apparently not rare in Costa Rica at 1,200 to 1,500 meters. The following additional specimen is received:

COSTA RICA: Sur les vieux troncs d'arbres aux collines supérieures de Santiago près San Ramón, *Brénes* 14419.

***Odontosoria guatemalensis*** Christ.

The known range of this species is now extended to include southern Mexico, two recent collections having come to hand from Chiapas: *Purpus* 6747, 6872. Three Guatemalan localities are known.<sup>2</sup>

<sup>1</sup> 16: 19. 1909.

<sup>2</sup> Contr. U. S. Nat. Herb. 17: 168. 1913.



***Polypodium myosuroides* Swartz.**

This species, whose history and relationship were discussed at length in the last paper of this series,<sup>1</sup> may now be reported from Porto Rico upon the basis of a single specimen collected by Mrs. Elizabeth G. Britton (no. 2670a) at Río de Maricao, altitude 500 to 600 meters, on rocks, April 2, 1913.

***Polystichum tridens* (Moore) Fée.**

Known hitherto only from Jamaica. The following specimen has been received under the wrong name *P. triangulum* var. *ilicifolium*:

SANTO DOMINGO: Azua, ad Las Cañitas, alt. 1,350 meters, August, 1912,  
*Fuertes* 1931.

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<sup>1</sup>Contr. U. S. Nat. Herb. 17: 398-406. 1914.



# BRANCHING AND FLOWERING HABITS OF CACAO AND PATASHTÉ.

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By O. F. COOK.

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## INTRODUCTION.

Cacao and patashté are tropical trees of the family Sterculiaceae. The cacao tree is familiar to botanists under the name *Theobroma cacao*.<sup>1</sup> The patashté is closely related to the cacao, but has been placed recently in a different genus, receiving the name *Tribroma bicolor*.<sup>2</sup> Both trees are widely cultivated among the Indians of Central and South America for the sake of their edible seeds, those of the cacao tree affording the raw material for the manufacture of chocolate.

Features of general botanical interest are presented by these trees in their peculiar habits of branching and floral specializations. The branching habits of the patashté are similar to those of the cacao and in some respects are even more peculiar, so that they afford one of the most striking illustrations of the phenomenon of branch dimorphism. But notwithstanding this general agreement in manner of branching, cacao and patashté differ widely in their habits of flowering and fruiting and the structures of their floral organs.

Though the patashté tree had always been treated botanically as very closely related to the cacao, a detailed comparison of the two trees in eastern Guatemala in 1906 showed so many differences that it seemed necessary to look upon the patashté as the type of a distinct genus. Another visit to Guatemala, in 1914, afforded an opportunity of repeating the observations and of securing additional specimens and photographs. A preliminary account of the genus *Tribroma* was published in 1915.<sup>3</sup>

The patashté tree, as well as the cacao, produces gourdlike elliptical pods filled with large fleshy seeds, which are used in the same manner

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<sup>1</sup> L. Sp. Pl. 782. 1753.

<sup>2</sup> *Tribroma bicolor* (Humb. & Bonpl.) Cook, Journ. Washington Acad. Sci. 5: 288. 1915.

*Theobroma bicolor* Humb. & Bonpl. Pl. Aequin. 1: 94. pls. 30a, 30b. 1808.

<sup>3</sup> Cook, O. F. *Tribroma*, a New Genus Related to *Theobroma*. Journ. Washington Acad. Sci. 5: 287-289. 1915.



as cacao among the native Indians of Guatemala. Though not considered the equal of cacao in quality, patashte is bought readily by the Indians and would undoubtedly find a place in commerce if it could be produced cheaply. Cacao and patashte are among the few articles that can be sold to the Indians for money. But not much cacao is grown in Guatemala and the coffee planters are often obliged to import cacao from the West Indies or from Ceylon to sell to their Indian laborers. The scanty production of cacao seems the more remarkable because the early accounts show that the Spanish conquerers found this tree in cultivation on a rather extensive scale by the Indians of Guatemala. A statement by Acosta, published near the end of the sixteenth century, makes it plain that Guatemala was recognized at that time as the chief center of production of cacao:

The tree whereon this fruite growes is of reasonable bignesse, and well fashioned; it is so tender, that to keep it from the burning of the Sunne, they plante neere unto it a great tree, which serves only to shade it, and they call it the mother of Cacao. There are plantations where they are grown like to the vines and olive trees of Spaine. The province where there is greatest trade in cacao is Guatimala. There grows none in Peru, but this country yields Coca, respecting which there is another still greater superstition.<sup>1</sup>

Since the patashte grows much more rapidly than cacao and develops eventually into a much larger tree, the possibility of securing profits from plantations of patashte has not altogether escaped the attention of enterprising landowners in Central America. That the patashte might serve as a shade tree in cacao plantations was an especially attractive idea, since most of the trees used for shade purposes yield nothing of direct value to the planter. The largest experiment in the planting of patashte known to us is in the Senahú district of the Department of Alta Verapaz, in eastern Guatemala, on the Trece Aguas Estate of Don Ricardo Fickert-Forst. Agriculturally speaking, the patashte plantation has not met expectations, the soil conditions having proved rather unfavorable, but the experiment afforded an unusually favorable opportunity of comparing the behavior of the two trees under the same conditions of growth.

Another possibility, as yet apparently untried, is that patashte might prove useful as a stock for the vegetative propagation of superior varieties of cacao. The greater vigor of growth shown by the patashte tree might make budding easier and more successful. Trees grafted on patashte might also grow more rapidly or be better adapted to special conditions, or to higher altitudes. At Trece Aguas the patashte trees seemed to have thriven better in the coffee plantations at altitudes of over 600 meters than in the lower valleys where they were planted with cacao.

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<sup>1</sup> The Natural and Moral History of the Indies, 1590. Hakluyt Society edition 1: 245. 1880.



**MORPHOLOGICAL AND ECOLOGICAL COMPARISONS.****DIMORPHISM OF BRANCHES.**

The crown of the patashté tree, like that of the cacao, is made up of two entirely distinct kinds of branches. These may be distinguished as uprights and laterals. The tree appears to consist of a main trunk bearing clusters of lateral branches, but when the stages of growth are observed it is seen that all of the primary lateral branches have at first a terminal position, standing at the end of an upright shoot. (See pls. 44-46.)

Though the trunk increases in length by the growth of upright shoots, these shoots do not form a continuous axis, but are strictly self-limiting. This is because each shoot, instead of carrying up a terminal bud to continue its growth, has the terminal bud replaced by a cluster of buds, and these give rise to a whorl of lateral branches. The specialization is very definite. Each of the upright shoots ends with a whorl of lateral branches and no lateral branches are produced except in this way—in whorls at the ends of the upright shoots. The lateral branches are capable of subdivision, but the divisions are always of the nature of laterals, uprights never being produced from laterals.

New upright shoots are formed only from dormant buds on the sides of the old uprights, below the terminal whorls of lateral branches. Thus the trunk is formed by a succession of upright shoots and is not only strictly sympodial but represents a very extreme type of sympodial structure.

As a result of this peculiar method of growth the whorls of lateral branches, though always formed in terminal positions, are brought eventually into lateral positions and appear as lateral clusters of branches instead of as whorls. When a new upright develops just below a whorl of branches the thickening of the trunk, as it were, incorporates the whorl, which remains in its original horizontal position, or nearly so, whereas when an upright starts several inches below the whorl the subsequent enlargement of the trunk throws the whorl over into an oblique position. Doubtless the result is influenced somewhat by the time when the new upright begins to grow. A whorl that had enlarged and formed a thickened woody base would be more difficult to push over into the oblique or lateral position.

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EXPLANATION OF PLATES 44-46.—Pl. 44, end of an upright shoot of cacao, with a whorl of 5 lateral branches. Pl. 45, uprights and lateral branches of cacao, the leaves of the uprights with long petioles and those of the laterals with short petioles, one of the uprights ending in a whorl of 6 small lateral branches. Pl. 46, upright shoot of patashté ending in a whorl of 3 lateral branches; some of the leaves are removed to give a better view of the petioles.



**PRACTICAL SIGNIFICANCE OF DIMORPHIC BRANCHES.**

Attention has been called in a previous publication <sup>1</sup> to the bearing of dimorphism upon cultural problems. After a further opportunity of studying the habits of branching it is still more apparent that the previous estimate of the practical importance of dimorphism is justified by the facts.

The cacao tree takes widely different forms, and these can be controlled by pruning. Left to themselves, most of the trees will produce an open crown formed by a succession of upright shoots and whorls of lateral branches. But some of the trees show a thick, spreading crown of secondary lateral branches. Such trees are preferred for cultural reasons, because they are much more productive. Though now their occurrence is determined entirely by accident, there seems to be no reason why they should not be produced regularly by design. Probably the best course would be to leave only one or two of the whorl branches, or at most three. But the experiment would be worth making with one, for the whorl joint is essentially weak and unsuited to more than temporary existence. With one whorl branch developing secondary laterals, as it might be encouraged to do by pinching off the terminal bud, a low rounded tree can be developed. The formation of uprights would need to be guarded against at first, but after a rounded top has been formed there seems to be little tendency to produce uprights.

The still more striking specialization of branching habit in the patashte tree serves to emphasize the peculiarities of the cacao tree and to explain the nature of the whorl formation, illustrating also the contrasting forms of top obtainable by controlling the method of branching. But the caulocarpous habit of the cacao tree renders it entirely different from the patashte in many of its biological features. The classification of trees of such widely different habits as species of the same genus tends to obscure the significance of the facts. This difficulty is avoided by recognizing the patashte tree as representing a genus distinct from *Theobroma*. Unless such differences of habit are clearly recognized there is little hope of applying the facts in the solution of cultural problems.

**NUMBERS OF LATERAL BRANCHES.**

Although cacao and patashte have the same method of forming lateral branches in whorls at the ends of upright shoots, there is a definite difference in the number of branches in a whorl. In patashte there are always 3 branches in a whorl, in cacao always more than 3 (pls. 44-46). The usual number in cacao is 5, but occasionally there are 4 or 6. If 6 branches were the normal number, it could be under-

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<sup>1</sup> Cook, O. F. Dimorphic Branches in Tropical Plants: Cotton, Coffee, Cacao, the Central American Rubber Tree, and the Banana. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 198. 1911.





UPRIGHT SHOOT OF CACAO.





UPRIGHTS AND LATERAL BRANCHES OF CACAO.





UPRIGHT SHOOT OF PATASHTE.



stood as representing two of the three-branched whorls of patashte. But a greater specialization must be admitted if 5 be considered as the normal number of branches in cacao.

The lateral branches of cacao are usually simple, at least at first, though afterwards producing many secondary laterals from axillary buds. In patashte the primary laterals often have a fork at the fifth or sixth internode from the base, as shown in plate 46. This forking results from the forcing of one of the axillary buds near the growing end of the branch, while the wood is still soft. The development of this bud appears to be almost simultaneous with that of the terminal, while buds of the other internodes remain dormant. The enlargement of the new shoot bends the smaller joints of the primary branch away from it, thus forming an apparently dichotomous fork. Apart from these forks near the base, the lateral branches of the patashte are usually simple, the tendency to produce secondary laterals from dormant buds being much weaker than in cacao, this difference being connected, no doubt, with the fact that the patashte produces its inflorescences on the new growth of the lateral branches, while cacao does not.

#### ARRANGEMENT OF LEAVES ON BRANCHES.

Cacao and patashte have the same phyllotaxy, five-thirteenths on the upright shoots and one-half on the lateral branches. This means that there are 13 rows of leaves on the upright shoots, but only 2 rows on the lateral branches. The number 5 in the phyllotaxy represents the number of times that the leaf spiral encircles the stem in passing from any leaf to the next that is directly above it. But it is not obvious that the number of turns in the spiral could have any practical relation to the number of branches developed to form a whorl.

#### DIMORPHISM OF LEAVES.

In connection with the dimorphism of branches there is a dimorphism of leaves, the leaves of the upright shoots being consistently different from those of the lateral branches. In cacao the difference is not very striking, being apparent only in the greater lengths of the petioles on the upright shoots. Usually the petioles are about an inch long on the lateral branches and 3 to 4 inches long on the upright shoots (pls. 44, 45). In patashte the disparity in lengths of petioles is much greater. With about the same length of 2.5 cm. for the petioles of the lateral branches, the leaves of upright shoots have petioles often attaining a length of 30 to 33 cm. (pls. 46, 47).

Along with this disparity in lengths of the petioles of patashte there are differences in the sizes and shapes of the blades of the leaves, those of the upright shoots being of a more broadly oval or cordate form, while those of the lateral branches are more nearly oblong or elliptic (pl. 47). Furthermore, the leaves of the uprights have the



blades flat, while the blades of the lateral branch leaves are strongly convex above and hollowed beneath. The lateral branches being generally horizontal, the leaves usually hang in a more or less drooping or pendent position, while the leaves of the upright shoots are usually held out flat, or nearly so, at the ends of their long stiff petioles. The position can be changed in accommodation to the exposure, for the petioles have two pulvini, the basal rather small and the terminal very large. If we consider the pulvini as organs distinct from the petiole, the difference between the two kinds of leaves of the patashte appears somewhat greater, in view of the fact that what has been looked upon as a petiole in the case of the lateral branch leaves is entirely of the nature of the pulvini, with nothing to represent the petiole proper, the structural element that intervenes between the basal and apical pulvini of the leaves of the upright shoots. A comparison of the petioles shown in natural size in plates 48 and 49 will make this point clear. From the difference in texture between the petioles and the pulvini it can be seen even from the photograph that the lateral branch leaves have only pulvini and not true petioles. While it would be overtechnical to describe the lateral branch leaves as sessile, instead of as having short petioles, the differences are really greater than the descriptive language implies.

In the case of the cacao there appears to be less in the way of structural differences between the petioles of the two classes of leaves. The petioles of the uprights are not so long and those of the lateral branches are not so short, and there is a definite constriction in the middle, between the thickened ends that represent the pulvini.

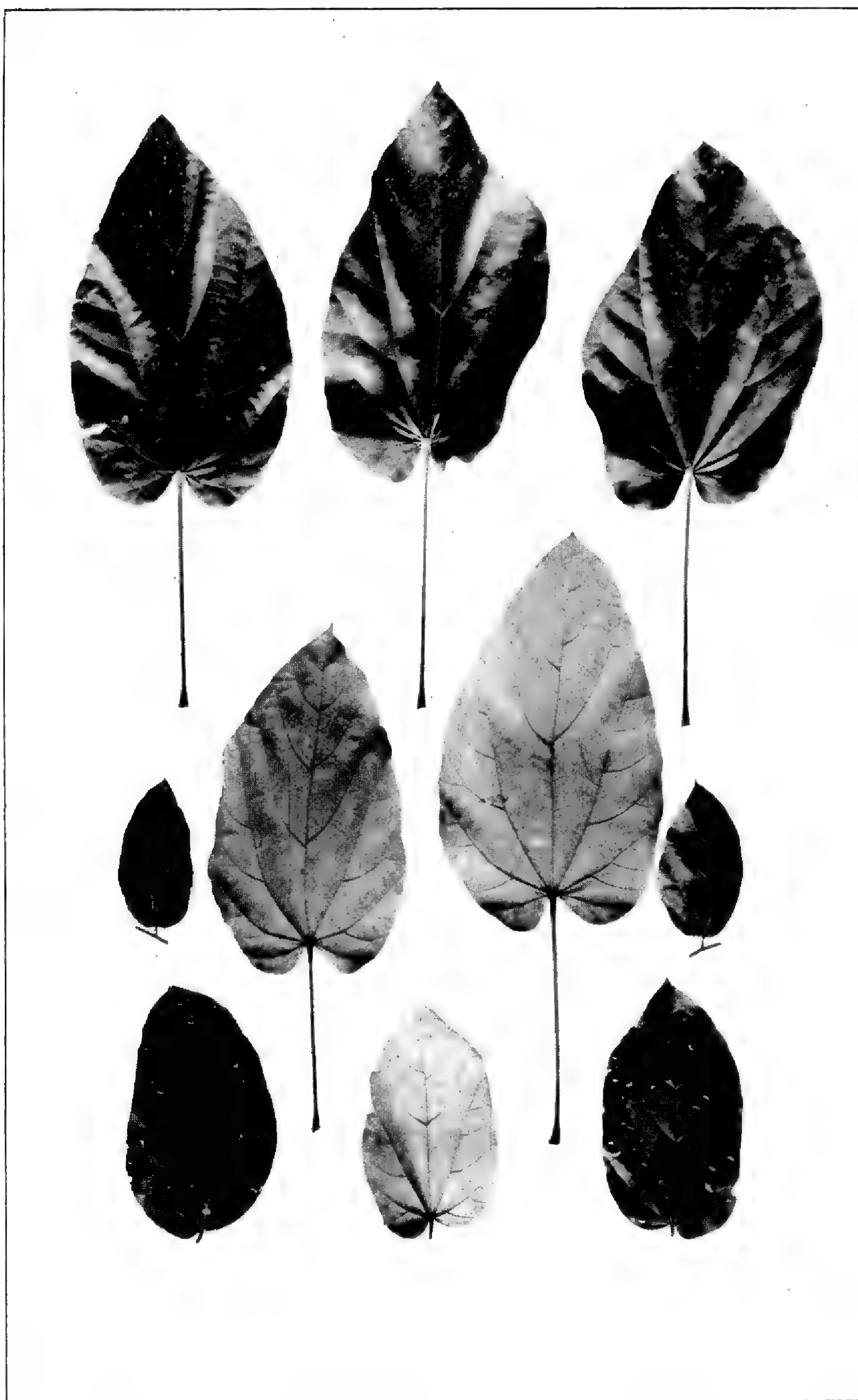
#### MEASUREMENTS OF PETIOLES AND LEAF BLADES.

The petioles on the upright shoots of the patashte attain a length of 34 cm., or about 13½ inches. Usually the length is about 30 cm. The blades of such leaves are sometimes 50 cm. long by 30 cm. wide, or nearly 20 inches by 11½, the base being broadly cordate, with a rather narrow sinus 5 to 6 cm. deep. Toward the ends of the upright shoots, below the whorls of lateral branches, the leaves are often much reduced in size and the petioles are much shorter. Usually these reduced upper leaves are about 30 cm. long by 20 cm. wide, with petioles 8 to 9 cm. long, but a leaf from just below a whorl was only 22 cm. long and 16.5 cm. wide. The petiole was 5 cm. long and the shallow basal sinus only about 1 cm. deep. These reduced leaves form an apparent transition to the form of leaves shown on the lateral branches as far as size and reduction of length of petiole are concerned, but there is no true overlapping, for very much larger leaves on the lateral

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EXPLANATION OF PLATES 47-49.—Leaf characters of patashte. Pl. 47, 5 leaves from an upright shoot, with long petioles, and 5 from a lateral branch with short petioles, to show the general difference in form and size of the blades. Pl. 48, section of upright with base and summit of petiole and lower part of blade, to show the pulvinus and the insertion of the veins. Pl. 49, portion of a lateral branch showing petioles and bases of 3 leaves to compare with corresponding parts of upright shoot, plate 48. Pls. 48 and 49 natural size.





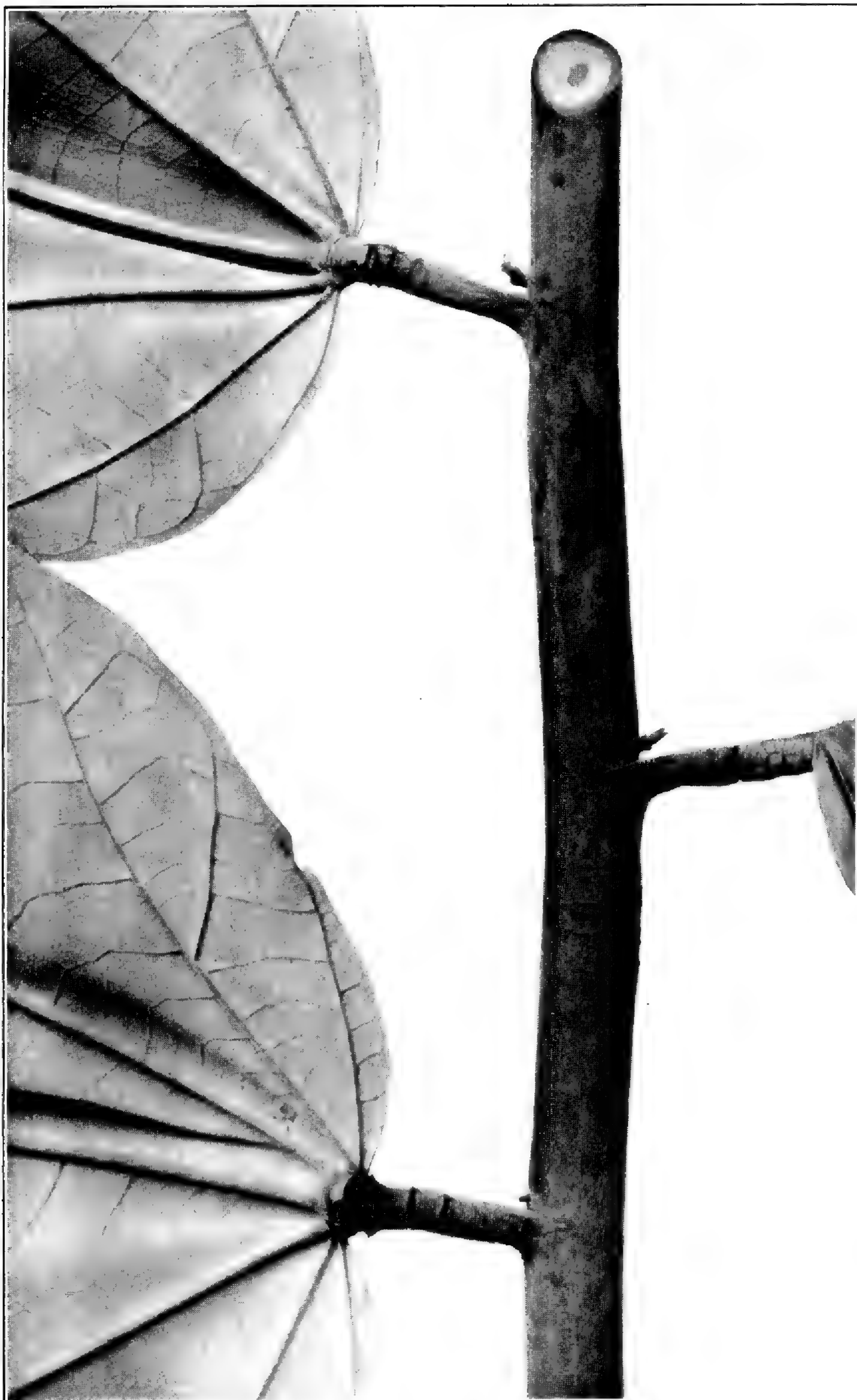
LEAVES OF PATASHTTE FROM UPRIGHT AND FROM LATERAL BRANCHES.





SECTION OF UPRIGHT SHOOT OF PATASHTTE WITH PARTS OF PETIOLE.





PORTION OF LATERAL BRANCH OF PATASHTÉ.



branches have shorter petioles than even the smallest leaves of the upright shoots. Thus in the shoot represented by plate 46 lateral branch leaves with blades 34 to 36 cm. by 20 to 22 cm. had petioles only 2.5 cm. long, or only half as long as the smallest leaves of the upright shoot.

In the case of cacao, where the petioles are less unequal, larger series of measurements are required to represent the differences. A series of leaves from the uprights shown in plate 45 measured (in centimeters) as follows:

Petiole length.	Blade length.	Blade width.
6.8	33	....
8	39	....
5.8	30	8
5.5	23.5	7
7	30.5	10
7	32	9.8
6	27.5	10
8.2	44	13
5.5	29	8
5.5	26	8.5
5.5	26.1	7.8

For comparison with these the following records were taken from the lateral branches shown at the top of plate 45. The uppermost branch, which was 35 cm. long, produced leaves as follows, beginning at the base:

Petiole length.	Blade length.	Blade width.
2.5	26.5	8.7
2.3	23.5	8
3.5	27	9.3
3.3	33	12
3.1	32.5	11.3
3	31	12
2.2	25	10.2
1.9	22	8

The leaves of another lateral branch, the second from the top of plate 45, were also measured, and the series is interesting for comparison with the preceding, because, although the leaves are very large for a lateral branch, the petioles are shorter than on the other less luxuriant branch:

Petiole length.	Blade length.	Blade width.
2.4	31 (about)	12
2.2	33	11
1.5	24	9
1.4	19.5	7
1.8	26	8.8
1.9	40.5	12.5
2	33.5	12
2.2	41	14.3
1.6	33	12.6
1.6	29.5	12
1.3	24.5	9.2



### VENATION OF LEAVES.

In connection with the greater degree of dimorphism shown by the leaves of patashte, there is another difference. The blades of patashte leaves not only have broader outlines, but show a different arrangement of the veins. The venation of patashte is palmate, while that of cacao is pinnate. Instead of a single strong primary vein or midvein which gives rise to all of the secondary veins, as in cacao, the leaf of patashte has several larger secondary veins, inserted directly on the basal pulvinus, which is broadened at the end to receive them. The structure of the pulvinus and the arrangement of the veins are shown in plates 48 and 49. With several of the veins in direct relation with the pulvinus, one side of the leaf may be raised in advance of the other whereas in cacao the entire leaf blade must be moved as a unit.

The palmate venation of patashte suggests a comparison with the related genus *Herrania*, which has palmately divided leaves, somewhat like those of the horse-chestnut (*Aesculus*). But there is little agreement with *Herrania* in other respects. The leaves of patashte might also be compared with those of some of the American species of *Sterculia*, such as *S. carthaginensis*.

### POSITIONS OF INFLORESCENCES.

Another very striking contrast is that cacao flowers are borne on the oldest wood, while the flowers of patashte are confined to the new growth, as shown in plates 50 and 51. It is not merely that cacao is caulocarpous while patashte is cladocarpous, but the very extremes of these habits are shown. The cacao tree flowers most abundantly and persistently on the main trunk itself, and more sparingly on the old wood of the larger and smaller branches, but never on the new growth. The contrast could not be made more complete; the cacao tree begins flowering at the base of the main trunk and never bears its flowers in the places where all of the flowers of patashte are borne, at the ends of the growing branches with the new leaves.

In the cacao tree the positions of the flowers in relation to the leaf scars may be studied, although the leaves fall long before the inflorescences appear. It has been learned in this way that the first inflorescences usually arise somewhat above the middle of the leaf scar, in the same relative position as the inflorescence of the patashte. But inflorescences that seem to be truly adventitious are found in other positions, and especially around the swollen bases of

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EXPLANATION OF PLATES 50, 51.—Pl. 50, inflorescences of patashte at flowering stage, with new leaves near the growing ends of branches. Pl. 51, trunk of cacao tree, producing flowers and fruits directly from the old wood, contrasting thus with patashte, as shown in plate 50. Pl. 50 natural size; pl. 51 reduced.





INFLORESCENCES OF PATASHTE.





TRUNK OF CACAO WITH FLOWERS AND FRUITS.



secondary branches, or on internodes at intermediate points between the insertions of the leaves, and this on shoots that appear to have made regular growth. The question is complicated by the fact that the leaves are often suppressed on some of the internodes, especially toward the ends of the upright shoots, and on the bases of the lateral branches, as shown in plate 45. Yet the suppression of the leaves can not be taken as proof that inflorescences would not be borne afterward in the axillary position, instead of being altogether adventitious. All that can be said with certainty is that the inflorescences often appear in places where no leaves have developed.

In patashté it can be seen that the inflorescences do not come from a strictly axillary position, but appear at one side of a dormant axillary bud, the side that is above the bud when the lateral branch is in its normal horizontal position. But in order to bring all of the inflorescence buds above the axillary buds they have to be placed on different sides of the axillary buds from the standpoint of phyllotaxy, and this must be reckoned as another very specialized feature of the lateral branches.

#### PERIODS OF FLOWERING.

In patashté only one inflorescence comes from a bud and only one crop of flowers is produced by each inflorescence. In cacao the floral buds are adventitious, with no apparent relation to the positions of the leaves, and an indefinite succession of new buds is produced from the same inflorescence. In Guatemala patashté seems to flower only during the dry season, consisting of the spring months, ending in May, but cacao produces a constant succession of flowers, though the crop is set rather irregularly, most of it late in the season in eastern Guatemala, after the period of heavy and frequent summer rains. In other districts the planters often speak of two or three crops at definite periods, but these may be determined more by favorable conditions for setting or developing the fruits than by interruptions of flowering.

#### STRUCTURE OF INFLORESCENCES.

As might be expected from their different positions and periods of production of flowers the inflorescences are not of the same form. Those of patashté may be described as many-branched, pseudodichotomous panicles or dichasia, solitary in the axils of new leaves, near the ends of lateral branches. The pseudodichotomy consists in the fact that the branch is equal to the main stalk at each subdivision, and the branch and the stalk stand at the same angle to the internode below. The inflorescence as a whole is subtended by a rather large sheathing bract. The basal joints are rather short, and the terminal joints, to which the flowers are attached, are still shorter,



both being greatly exceeded by some of the intermediate joints (pls. 50, 52).

In cacao the branching framework of the inflorescence is almost entirely eliminated, or reduced to a very short specialized twig or fruit spur. The joints are reduced to mere rudiments, except the terminal ones, and these are much longer than in patashte. The pedicels of the flowers are usually 2 or 3 times as long as the branches that bear them. For practical purposes the flowers of cacao might be described as almost sessile, on the short, simple branches of a rudimentary inflorescence. In patashte, on the other hand, there is a compound inflorescence with many joints exceeding the length of the pedicels of the flowers (pls. 52, 53).

#### STRUCTURE OF FLOWERS.

Though the flowers of the two trees are built upon the same general plan, all of the details of construction seem to be different. The flowers of cacao are not only larger and more ample in all their parts, but each part seems to show a different line of specialization. The pedicels of cacao are longer, the sepals are longer, narrower, and more reflexed, the petals are very much larger with the parts differently proportioned, and the staminodes are of a different form, slender and attenuate in cacao, robust and clavate in patashte. The sepals, petals, and staminodes of cacao are brightly colored, light yellow tinged with pink, while the corresponding parts of the patashte are a dull deep red. Another general contrasting feature is that the inflorescences, pedicels, sepals, and pistils of cacao are beset with long, erect, gland-tipped hairs, the corresponding organs of patashte being very finely pubescent but the hairs appressed and not at all glandular (pls. 52, 53.)

More minutely studied, the floral structures present further differences. The sepals of the patashte, in addition to having a much more broadly triangular form, are not separated completely to the base and do not open as widely as those of cacao, but retain more nearly the same position as in the bud. The tips of the sepals become more strongly inflexed as the flowers begin to wilt, instead of remaining straight or becoming reflexed as in cacao.

The petals of patashte are much shorter than the sepals, while those of cacao, if fully extended, would be much longer than the sepals. The petals of cacao are divisible into three parts about equal in length, the inflated basal hood for the reception of the anthers, a narrow,

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EXPLANATION OF PLATE 52.—Inflorescence of patashte, with buds and open flowers and, detached, a flower with part of the sepals and petals removed, and with a cluster of staminodes and 2 petals. Scale about 2½.

EXPLANATION OF PLATE 53.—Inflorescences of cacao, with buds and open flowers and, detached, 2 complete flowers, a flower with part of the sepals and petals removed, and 2 petals. Scale about 2½.

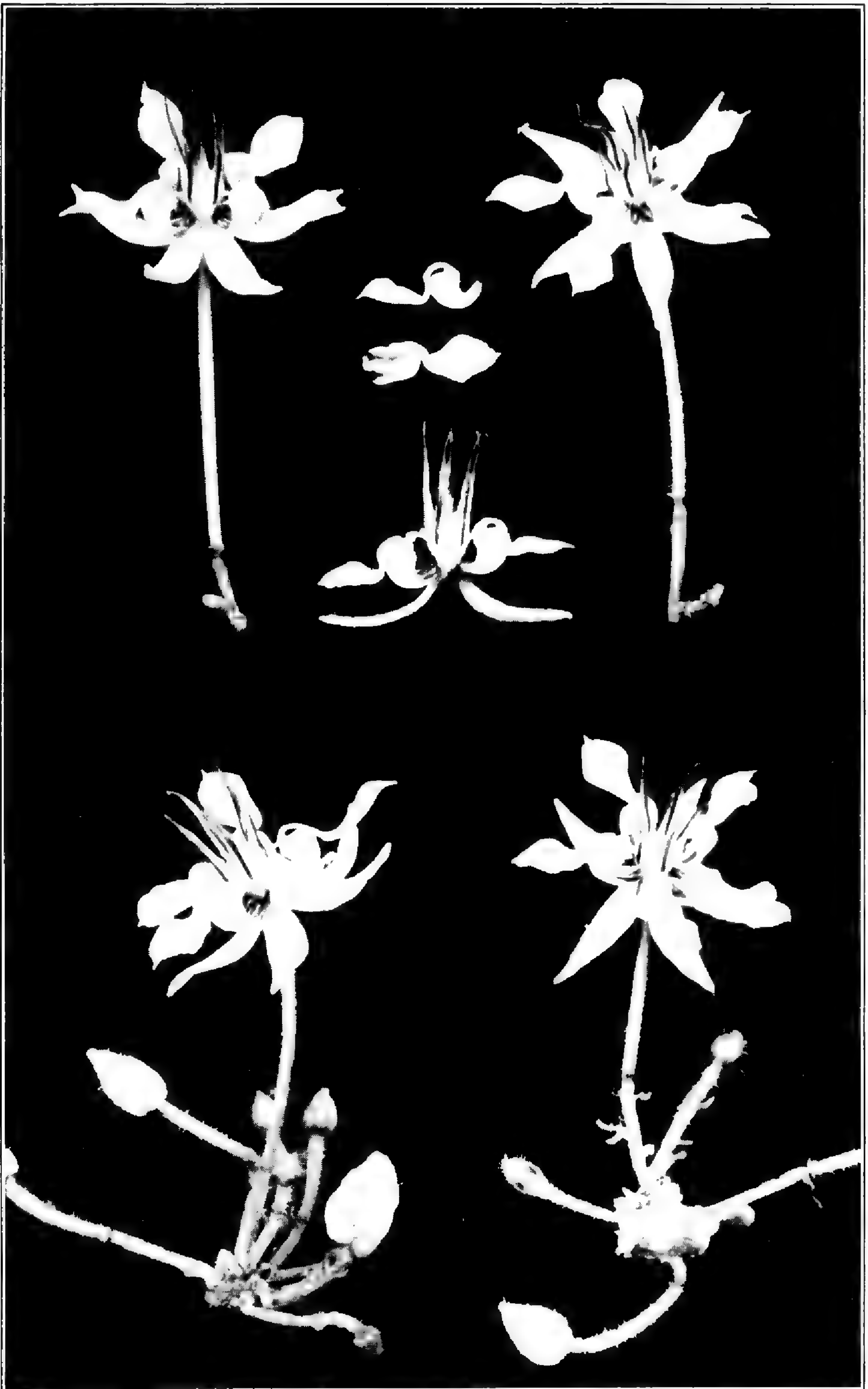
EXPLANATION OF PLATE 54.—Fruit of patashte, from Hope Botanical Garden, Jamaica. Natural size. Photograph by Mr. G. N. Collins.





INFLORESCENCE OF PATASHTTE WITH DISSECTED FLOWERS.





FLOWERS OF CACAO.





FRUIT OF PATASHTE.



strongly reflexed middle portion, or isthmus, and a broadly diamond-shaped terminal expansion, or wing, with rounded lateral angles and an acute, sharp-pointed tip. The hood is strengthened at the base by two prominent parallel ribs, deep red in color, with a short median rib above, but not reaching the base. In patashté the petals are only about half as long as the sepals, the claw and wing being rudimentary and represented by minute paddle-shaped appendages of the hood. The appendage is oval in form, rather thick and fleshy, and with the surface pubescent, while in cacao all of the parts of the petals have naked surfaces. The form of the hood is also different, being much less curved, and the base is strengthened by a single median rib, divided above into three short branches.

The staminodes also show several contrasting characters, being slender, tapering, and needle-like in cacao, while in patashté they are robust, clavate, and blunt-pointed. In cacao there is a lateral compression of the staminodes, in patashté a dorsiventral compression, with shallow grooves on the inner and outer faces. In cacao the lateral faces of the staminodes are hirsute along the middle, while the outer and inner faces are smooth and shining. In patashté the whole terminal portion of the staminode has a close, short pubescence, but not the basal portion. The color of the staminodes is a very deep purplish red in patashté, while in cacao the lateral faces are white and the other faces show bands of purple, though the color is not decurrent upon the staminal tube. In patashté, on the other hand, the darker color of the staminodes is decurrent in broad bands upon the staminal ring. The surface of the ring is naked in patashté, but covered with a whitish pubescence in cacao. The ovary of cacao is rounded and beset with short glandular hairs, while that of patashté is distinctively 5-angled and densely covered with short, nonglandular pubescence. The style of patashté is 5-grooved and more tapering than that of cacao and also somewhat longer, extending beyond the middle of the staminodes.

As mentioned in the introduction, the fruit of the patashté is an ellipsoid pod, large, and large-seeded. For comparison of this with the fruit of cacao see the generic descriptions, page 624, and the illustrations, plates 51, 53.

#### FLORAL ADAPTATIONS.

The structure of the flowers of both trees indicates a very definite adaptation for cross-fertilization. Only half of the stamens are functional, the others being modified into large erect staminodes. The functional stamens are not erect but are bent far outward away from the stigma, being held by a notch in the rim of a large inflated hood-like cavity at the base of the petal. Thus the anthers are completely covered and kept from any possibility of contact with the



stigma. But in spite of their agreement in this feature of holding the stamens away from the pistil, the floral biology of the two trees is apparently very different.

The caulocarpous habit, shared by cacao with many tropical trees, has been looked upon as an adaptation to favor cross-fertilization by ants or other small crawling insects, but the striking form and conspicuous coloration of the cacao flowers, as well as their highly specialized structure, suggests that flying insects are attracted. The glandular pubescence of the calyx and sepals may also be considered as an adaptation that tends to discourage the attention of small crawling insects.

With the patashte the case is obviously different. The petals, instead of being conspicuous and bright-colored, are greatly reduced, or even rudimentary. The dull color of the flowers and their altogether different position on the tree make it evident that they are not adapted to attract the same class of insect visitors as the flowers of the cacao. The patashte flowers are carried up to the light and are probably visited by bees or other sun-loving, day-flying insects that might never go down into the darkness to find the flowers of cacao. The nonglandular character of the pubescence of the patashte flowers may be significant from this point of view.

A new interpretation of the floral biology of cacao is presented in a recent work by Dr. C. J. J. van Hall. The fact of variation among cacao seedlings is brought forward as evidence that crossing is of frequent occurrence, and the following explanation is given:

This strong intercrossing indicates that the pollen can be transported from one tree to another. The transport might be effected in two ways, either by wind, or by flying insects such as butterflies, wasps, bees, flies—but not by thrips, aphides, or ants, none of which fly at all, and of which thrips and aphids can only move very slowly.

The question whether pollination takes place by wind or by flying insects seemed at first difficult to answer, because the flower of the cocoa does not appear to be adapted to wind-pollinisation, and flying insects were never found. Accordingly, the whole question for long remained a puzzle. Happily, however, a thorough investigation has lately been carried out by Dr. von Faber at Buitenzorg (Java), and this investigation solved the question.

Dr. von Faber has kindly given the present writer a short summary of his results, with permission to incorporate it here. He writes as follows:

“Though the structure of the flower seems to eliminate the possibility of self-pollination, this is really not so. The long and supple flower stalk facilitates the swinging to and fro of the hanging flower by the wind. Experiments proved that by this movement pollen easily falls from the anthers on the pistil of the same flower, and it could be demonstrated that isolated flowers were easily self-pollinated in this way. Self-pollination may therefore be regarded to be the rule in the cocoa-flower. When, however, neighbouring trees stand close to each other, it is also possible that the pollen falls from the hanging blossoms and settles on the pistil of flowers of the neighbouring tree. In this way cross-fertilisation is possible when the trees stand in close proximity, as is the case in all plantations.”<sup>1</sup>

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<sup>1</sup> Van Hall, C. J. J. Cocoa 54. (London, 1914.)



One can only regret being unable to share the confidence of Dr. van Hall in the statement just quoted. Indeed, it is hard to believe that this account can relate to cacao. It suggests, rather, the question whether there is another tree in Java that could have been mistaken for cacao. As may be seen by reference to the photographs reproduced in plates 51 and 53, the flower stalks of cacao are neither long nor "supple," nor do the flowers hang in a pendent position that would enable them to swing in the wind. The most drooping or nearly pendent flowers often have their petals in contact with the surface of the bark. No doubt some of the flowers might be made to flutter by a strong breeze, but there could be no "swinging to and fro" unless the pedicels were wilted. The stalks are strong enough to hold the flowers rather firmly in place. It may not be impossible that grains of pollen would reach the stigma if the flowers were sufficiently beaten about, but the preference of the tree for moist, sheltered situations and its peculiar habit of producing its flowers in the most sheltered positions are opposed to the idea that it is normally dependent on wind pollination. Even stronger reasons against this view are afforded by the structure of the flower itself, with its reduced number of anthers and the very small quantity of pollen. In several other respects the flowers are as highly specialized as those of orchids, asclepiads, or other groups that are known to be dependent on insects. It would be difficult to find adaptive functions for these specializations under a theory of wind pollination. Indeed, this theory may be said to dismiss the problem of the cacao flower, instead of giving a solution.

The theory that seems most worthy of consideration, on the basis of present information, is that proposed by Uzel, that the pollen may be carried by thrips, a suggestion dismissed by van Hall because thrips is injurious to cacao. Yet this hardly excludes the possibility of a beneficial function being performed by the same insects, or by other members of the same order. Some of the Thysanoptera are very active, free-flying insects, a fact that van Hall seems to overlook. The small size of the chambers that shelter the anthers may be taken to indicate that they are to be entered by small insects. The fact that the stamens are held in a notch of the petals naturally gives an impression that they are to be released or "tripped" by a large insect such as a butterfly, bee, wasp, or fly, but this may prove not to be the case. A small insect could enter the petal hood from the side and bring out pollen without disturbing the stamens. The staminodes also would appear more likely to have a function in relation to small insects, since these organs form a complete ring around the pistil and are hirsute on their lateral faces as if to keep small insects from passing between.



### QUESTION OF NATIVITY.

Obviously, the pollination problem needs to be investigated in the forests of tropical America rather than in Java or elsewhere in the East Indies. The identity of the insect visitors and the true meaning of the floral and other specializations can hardly be determined satisfactorily until the trees can be studied in their native habitats, which are still to be ascertained. The present wide distribution of cacao and patashte, from Mexico to Brazil, is probably due to human agency. The patashte tree was described originally from Colombia, and is said to grow wild in the Amazon Valley. The cultivation of cacao extends along the eastern slopes of the Andes into southern Peru and Bolivia, but in these countries is not supposed to be ancient. There appears to be no native name for cacao in the Quichua language. Nevertheless, one of the varieties of cacao cultivated about Santa Ana in the lower Urubamba Valley in the Department of Cuzco is known as "cacao chuncho," or cacao of the forest Indians, from whom it is supposed to have come.

It does not seem reasonable to believe that trees with such habits would attain extensive distributions through natural agencies. In Guatemala it is supposed that both the cacao and patashte grow wild in the woods, but the trees occur only sparingly and perhaps only in districts that were formerly occupied by the Indians. On the peninsula of Nicoya, on the Pacific side of Costa Rica, wild cacao is more abundant, but still in places that may have been cleared and cultivated by the Indians a few generations ago.

### ECOLOGICAL SIGNIFICANCE OF DIFFERENT HABITS.

The behavior of the patashte at Trece Aguas would seem to indicate that this tree has habits very different from those of the true cacao. It appears to be much less tolerant of shade and better adapted for growing long uprights every year and thus keeping above the surrounding vegetation. The flowers and fruits are carried up to the light on the new growth, instead of being borne on the old wood down in the deep shade. As might be inferred from these habits of growth, the lateral branches seem to be of a temporary nature and apparently live only a few years, producing a few annual crops of flowers, like the lateral branches of coffee. The lateral branches lose their functions as soon as they are covered by new vegetation above. Thus, while the tree might become very tall if growing in the forest, it would probably have only a small crown of a few branches alive at any one time. The trunk would serve only as the support of the few branches and would probably remain very slender. But in open places with favorable soil conditions a more spreading



habit is assumed, the lateral branches grow longer, and the uprights are more numerous and divergent. But any tree with these habits of growth would probably be short-lived, for the constant succession of dead branches invites fungous diseases and insect pests.

#### LATERAL BRANCHES CONSIDERED AS INFLORESCENCES.

The positions and functions of the inflorescences need to be taken into account in dealing with problems of the origin or nature of the dimorphic branches. In other plants that have specialized lateral branches, such as *Gossypium*, *Coffea*, and *Castilla*, it seems not unreasonable to look upon these branches as inflorescences that are being made to serve vegetative functions in addition to bearing the flowers. The form of the inflorescence, as determined by its method of branching, is closely analogous to that of the lateral branch. It might be easier, from a morphological standpoint, to think of the leaves of the lateral branches as representing large floral bracts than as direct specializations from the form of leaves produced by the upright shoots.

In the case of cacao it seems rather difficult to apply this theory, since it involves the assumption that the cacao tree, or its ancestors, after developing the lateral branches as inflorescences in the manner of patashté, at a later stage of development transferred the flowers to the trunk and other parts of the old wood. This would amount to saying that the cacao tree had removed the flowers from the inflorescences, so that only vegetative purposes are now served by the parts of the tree that were specialized originally for the production of the flowers and fruits in the manner still shown in the patashté. If this view of the caulocarpous habit be adopted, the cacao tree must be taken to represent a more advanced stage of evolution than the patashté.

The fact that the lateral branches of cacao have become more similar to the uprights, both in function and in form of leaves, than those of patashté, could be taken as another indication of more advanced evolution, since it would seem to represent a greater departure from a condition in which the lateral branches functioned as inflorescences. It is quite possible that the nature and extent of the specializations will be found to differ in the other species and varieties of *Theobroma*, and that these differences will prove useful in classification as well as in the solution of cultural problems. The differences between cacao and patashté that have been considered in the present paper are summarized in the following contrasted descriptions of the genera *Theobroma* and *Tribroma*.



## DESCRIPTIONS OF THE GENERA.

### THEOBROMA L.

*Theobroma* L. Sp. Pl. 782. 1753.

PLATES 44, 45, 51, 53.

Low, shade-tolerant trees of tropical undergrowth, the lateral branches formed in terminal clusters of 5, rarely 4 or 6.

Leaves elliptic-obovate, narrowed toward the base, pinnately veined, naked on both surfaces, the petioles and young shoots hirsute with stiff erect bristles; leaves of lateral branches of the same form as those of the upright shoots, the petioles somewhat shorter, but the pulvini distinct at each end.

Inflorescences reduced to minute fleshy twigs, only the terminal joints distinct and these shorter than the pedicels of the flowers, produced from adventitious buds on old wood of the main trunk or the larger branches appearing long after the leaves.

Flowers larger than in *Tribroma*, the sepals and petals both conspicuous, light-colored, widely expanded; sepals narrow, tapering, and reflexed; petals longer than the sepals, strongly curved or folded in the bud, the basal hood with two strong parallel ribs, the limb longer than the hood and with a slender base folded down around the end of the hood; staminodes slender, naked, and tapering above, laterally compressed below, with bands of long hairs on the lateral faces; ovary rounded, covered with glandular pubescence like the sepals and the pedicel.

Fruits obovate or fusiform, with a thick fleshy rind, longitudinally ridged and furrowed, the surface smooth or tuberculate.

### TRIBROMA Cook.

*Tribroma* Cook, Journ. Washington Acad. Sci. 5: 288. 1915. PLATES 46-50, 52, 54.

Slender, erect trees, with strong upright shoots, each ending in a whorled cluster of three lateral branches.

Leaves of upright shoots with long petioles and broadly ovate-cordate blades, palmately veined, naked above, clothed underneath with a very fine dense appressed stellate pubescence, like the surfaces of the branches and petioles; leaves of lateral branches broadly ovate-oblong, subsessile, the petioles very short and representing only the confluent pulvini.

Inflorescences with pseudodichotomous branching, bracted at the articulations, forming a broad loose panicle or dichasium, produced near the ends of the lateral branches, above the axillary buds of the young leaves, entirely confined to the new growth.

Flowers small, inconspicuous, dark-colored, dull reddish purple, the petals minute and the sepals only partly opened; sepals broadly triangular, inflexed; petals much shorter than the sepals, the basal hood with a single median rib, the limb rudimentary, represented by a minute oval, reflexed, nearly sessile appendage; staminodes robust, clavate, clothed above with short pubescence, naked below; ovary 5-angled, finely pubescent like the pedicels, sepals, petals, and staminodes, but none of the pubescence glandular.

Fruits ellipsoid with a very hard woody shell, the surface broken by deep irregular lacunæ.

These descriptions relate, of necessity, to the forms of cacao and patashte that are cultivated in eastern Guatemala, where the comparison was made. It is not to be expected that all of the contrasted features will be shared in the same degree by all of the members of the genera. Some forms of cultivated cacao are less caulocarpous than others, and some have the inflorescence branches along the trunk



developed into stout woody twigs. Several of the species now referred to *Theobroma* are only imperfectly known. Some of them differ widely from the cacao, but apparently without approaching nearer to the patashté. It may be that a more definite recognition of the differences between these two will facilitate the study and classification of the other members of the group by affording a larger series of diagnostic characters.



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[Synonyms in italic. Page numbers of principal entries in heavy-face type.]

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